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ANNUAL REPORT
of the
NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR
FOR THE SCHOOL YEAR
1942-1943

STATE TEACHERS COLLEGE
AT
MONTCLAIR

TABLE OF REPORTS

President 1-42

Dean of Instruction 43-47

Registrar 48-55

Summer Session, Part-Time, and Extension. 56-58

College High School 59-63

Director of Personnel and Research. 64-69

Library . . . .

College Library. 70-74
College High School Library. 75-77
Visual Aids Service. 78-79

Medical Department. 80-82

Department of Business Education. 83-89

Department of English 90-105

Department of Geography 106-108

Department of Integration 109-111

Department of Languages 112-116

Department of Mathematics 117-128

Department of Music 129-133

Department of Physical Education for Women. 134-137

Department of Physical Education for Men. 138-140

Department of Science 141-151

ANNUAL REPORT FOR THE NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

FOR THE SCHOOL YEAR 1942-1943

To the Commissioner of Education:

I have the honor to present the following brief report of the work of the New Jersey State Teachers College at Montclair for the year 1942-1943. Accompanying this report will be found the annual reports of the various departments and agencies in the college.

For the college year 1941-1942, a detailed report was given on teacher education in relation to war needs. The previous year my report emphasized scholastic developments and college standards. The year before that, 1939-1940, special emphasis was given to faculty research studies, publications, and memberships in learned societies. The report of the President for 1942-1943 will present a special study of student enrollments over a five year period, together with a discussion of related problems.

I. College Developments

A. Student Enrollment and Related Problems

A special report on the program of education at Montclair State Teachers College in its relation to the war was the most significant problem last year and continues to be of major importance. However, attention has been turned to a major internal or institutional problem, i.e., student enrollment. This is a significant problem at this time because of manpower and teacher shortage in New Jersey and also because it is the responsibility of the administration to preserve the necessary elements of the organization and the standards of the institution.

The following data and interpretations constitute a special report on student enrollment and related problems during a period of war.

1. Table I - Enrollment in Freshman, Sophomore, Junior, and Senior Classes by Men and Women for the Five Year Period Beginning February 1, 1939, and Ending February 1, 1943.

	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943
FRESHMEN					
Men	67	49	51	55	58
Women	102	116	120	129	165
Total	169	165	171	184	223
% of Grand Total	22%	23%	26%	29%	38%
SOPHOMORES					
Men	55	62	53	50	42
Women	116	97	112	114	130
Total	171	159	165	164	172
% of Grand Total	23%	23%	25%	26%	30%
JUNIORS					
Men	71	58	61	53	10
Women	133	114	94	104	35
Total	204	172	155	157	45
% of Grand Total	27%	24%	24%	24%	8%
SENIORS					
Men	60	68	53	49	39
Women	151	140	111	87	103
Total	211	208	164	136	142
% of Grand Total	28%	30%	25%	21%	24%
GRAND TOTAL	755	704	655	641	581

It may be noticed from Table I that the following increases or decreases have taken place during the five year period from 1938-1939 to 1942-1943.

a. The number in the senior classes has decreased quite markedly since 1940. This is due to the fact that the entering classes during the mid-thirties were large and as shown in the Table, the entering classes from 1938 to 1940 were comparatively small. Furthermore, the number of withdrawals since 1940 has increased (see Table IV).

b. Total enrollments decreased gradually from 1939 to 1943. This was due largely to withdrawals for military service, to the reduced number admitted during previous years, and to the accelerated program.

c. There has not been a marked decrease in the number of men entering the freshman classes since 1938. The number of women admitted each year has increased. The number of men and women enrolled in the sophomore classes has remained quite constant. Marked decreases may be noted in the number

enrolled in the junior classes due to reasons cited under Item 1, a. and also to the accelerated program which accounts particularly for the small percentage of the total (8%) in the junior class in 1942-1943.

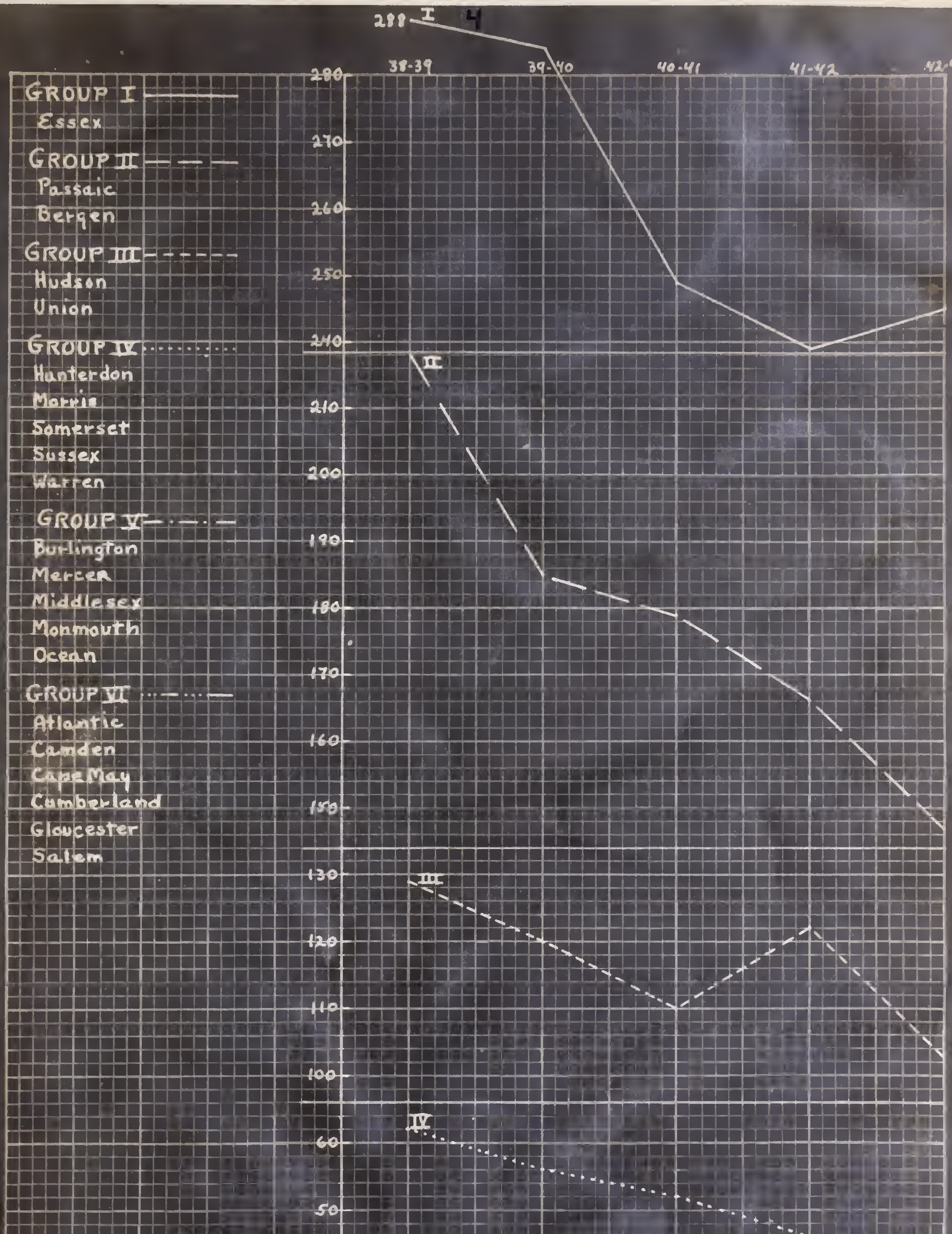
d. It will be noted that the number enrolled in the freshman classes in 1941-1942 and 1942-1943 increased. This was due to special recruiting efforts and a more general acceptance of the candidates who applied.

2. Table II - Enrollment by Counties for the Period from February 1, 1939 to February 1, 1943.

	1938-1939			1939-1940			1940-1941			1941-1942			1942-1943			County	% of
	M	W	T	M	W	T	M	W	T	M	W	T	M	W	T	Totals	G.T.
Atlantic	3	7	10	2	9	11	2	7	9	4	4	8	3	1	4	42	1.3%
Bergen	35	56	91	29	55	84	29	55	84	29	52	81	19	38	57	397	11.9
Burlington	-	1	1	1	3	4	1	3	4	1	2	3	-	2	2	14	.4
Camden	-	8	8	-	7	7	1	8	9	1	7	8	1	5	6	38	1.1
Cape May	-	-	-	-	1	1	-	1	1	-	1	1	1	1	2	5	.1
Cumberland	1	5	6	-	4	4	-	6	6	1	5	6	-	5	5	27	.8
Essex	109	179	288	106	278	284	97	152	249	87	152	239	69	176	245	1305	39.1
Gloucester	-	-	-	1	-	1	1	1	2	1	1	2	-	2	2	7	.2
Hudson	25	49	74	23	43	66	21	40	61	19	47	66	14	48	62	329	9.9
Hunterdon	-	4	4	1	4	5	1	2	3	1	2	3	-	-	-	15	.4
Mercer	-	-	-	1	1	2	1	1	2	2	1	3	-	1	1	8	.2
Middlesex	2	3	5	5	1	5	5	3	8	4	6	10	2	6	8	36	1.1
Monmouth	4	15	19	5	14	19	6	15	21	5	15	20	5	11	16	95	2.8
Morris	9	28	37	6	29	35	6	26	32	5	20	25	4	13	17	146	4.4
Ocean	-	5	5	1	3	4	2	2	4	1	5	6	-	4	4	23	.7
Passaic	45	82	127	40	61	101	29	65	94	24	61	85	20	70	90	497	14.9
Salem	-	4	4	-	1	1	-	-	-	-	1	1	-	1	1	7	.2
Somerset	2	7	9	1	5	6	2	6	8	4	5	9	5	6	11	43	1.3
Sussex	1	7	8	-	7	7	-	6	6	-	3	3	-	4	4	28	.8
Union	16	39	55	15	39	54	13	36	49	15	41	56	6	35	41	255	7.6
Warren	1	3	4	1	2	3	1	2	3	2	4	6	-	3	3	19	.6
TOTALS	253	502	755	237	467	704	218	437	655	206	435	641	149	432	581	3336	99.8%
% of Decrease			3%			7%			8%			2%			10%		

It may be noted from Table II that 75.8% of Montclair's students come from neighboring counties - Essex County (39.1%), Passaic County (14.9%), Bergen County (11.9%), and Hudson County (9.9%). The smallest percentages come from the southern and northern counties. This is due in part to proximity and density of population to draw from.

The following chart shows the distribution of enrolled students over a five year period by counties grouped geographically.



ENROLLMENT BY COUNTIES GROUPED GEOGRAPHICALLY

The five most populous counties in the State were placed in three groups. Essex County is treated separately because alone it contributes and maintains the largest portion of the total enrollment. Almost continuous decreases may be noted from Groups I, II, III, and IV, slight increases from the central and southern counties (Groups V and VI) continued up to 1941-1942.

3. Table III - Number of Freshmen Admitted over Five Year Period

	MEN	WOMEN	TOTAL
1938-1939	65	108	173
1939-1940	49	117	166
1940-1941	52	126	178
1941-1942	56 (Sept - 48 Feb. - 8)	135 (Sept - 130 Feb. - 5)	191
1942-1943	68 (Jan - 14 May & Sept - 54)	177 (Jan - 27 May & Sept - 150)	245

The number of freshmen admitted each year differs from the number of freshmen enrolled on February 1st of each year as shown in Table I. The greatest variation may be noted in the year 1942-1943 when 245 were admitted and 223 were in attendance in February. During this year, freshmen were admitted at the beginning of the second semester in January, at the beginning of the summer term in May, and at the beginning of the college year in September.

It will be noted that there has been an increase in both the number of men and the number of women admitted over the five year period. The increase in total men and women admitted since 1939-1940 has been from 166 to 245. It may be said that if the college can maintain its practice of admitting large entering classes, it will soon overcome the unusual declines in total enrollment caused by withdrawals for military service (103 since 1941) and the accelerated program which graduates two or three classes per year.

4. Table IV – Withdrawals and Causes for Withdrawals over Five Year Period.

CAUSE	1938-39		1939-40		1940-41		1941-42		1942-43		TOTAL		TOTAL
	M	W	M	W	M	W	M	W	M	W	M	W	
Financial	-	1	3	-	2	3	1	2	-	3	6	9	15
Health	2	2	1	-	1	3	1	1	1	3	6	9	15
Not Given	1	4	3	10	3	2	1	8	4	5	12	29	41
Transfer to Other Schools	2	1	1	2	2	1	2	6	-	7	7	17	24
Married	-	2	-	1	-	4	-	2	-	2	-	11	11
Family Reasons	-	1	1	-	1	-	-	1	-	1	2	3	5
Dropped by College	1	1	6	5	7	7	2	5	2	1	18	19	37
Employment	1	-	-	-	3	4	3	9	8	5	15	18	33
Not Interested in Teaching	-	1	-	-	1	1	-	-	-	1	1	3	4
Moved from State	-	-	-	2	-	-	-	1	-	-	-	3	3
U. S. Service	-	-	-	-	-	-	12	-	90	1	102	1	103
Died	-	-	-	-	-	-	1	1	-	-	1	1	2
Homesick	-	-	-	-	-	-	-	-	1	-	1	-	1
Total by M & W	7	13	15	20	20	25	23	36	106	29	171	123	294
GRAND TOTAL	20		35		45		59		135				

Table IV shows a continual increase in the number of withdrawals over the five year period beginning in 1938. Normally, about 25 students withdraw per year, however, the average for the past five years has been nearly 60. Prior to the college year of 1941-1942, the range was from 20 to 59. In 1942-1943 the withdrawals amounted to 135 or 125% above the average for the five year war period and 350% above normal. Nearly two-thirds of the withdrawals for the five year period (294) were made during the last two years. The chief causes in order of importance are U. S. Service, dropped from college, and employment. These three causes account for 103, 37, and 33 respectively and total 173 or nearly 60% of the total. Comparatively, the ratio of men to women withdrawn is nearly three to two, while the ratio of men to women enrolled has been about one to two. The total number of men now enrolled is less than 60.

5. Table V - Students Admitted on Advanced Standing, July 1, 1938 to June 30, 1943

Year	Seniors	Juniors	Sophomores	Freshmen	Total
1938-39	-	10	15	5	30
1939-40	-	6	7	-	13
1940-41	-	6	12	3	21
1941-42	1	12	13	1	27
1942-43	-	18	13	3	34
TOTAL	1	52	60	12	125

Approximately 90% of all students admitted on advanced standing entered the sophomore and junior classes. A few freshmen have been admitted from other teachers colleges in the state. The number admitted by years has ranged from 13 to 34 and the average is 25. 34 of the 125 students admitted on advanced standing withdrew before graduation and 91 have graduated or are in attendance.

6. Table VI - Student Enrollment by Majors

	1938-39	1939-40	1940-41	1941-42	1942-43
Business Education	29	49	79	103	82
English	216	179	159	141	142
Languages	128	126	102	98	72
Mathematics	119	95	91	89	84
Science	79	88	66	73	66
Social Studies	184	167	158	137	135
TOTALS	755	704	655	641	581

Table VII - Percentage of Total Number of Students Enrolled in Each Major Each Year

	1938-39	1939-40	1940-41	1941-42	1942-43
TOTALS	755	704	655	641	581
	% of Tot.	% of Tot.	% of Tot.	% of Tot.	% of Tot.
Business Education	4%	7%	12%	16%	14%
English	29%	25%	24%	22%	25%
Languages	17%	18%	16%	15%	12%
Mathematics	16%	13%	14%	14%	14%
Science	10%	13%	10%	11%	11%
Social Studies	24%	24%	24%	22%	24%

Decreases may be noticed in the enrollments in each major with the exception of Business Education which had a 255% increase from 1938-1939 to 1941-1942 and then a decrease of about 20% in 1942-1943. The greatest decreases over the five year period have been in English, Languages, and Social Studies. Since 1939 Mathematics and Science have maintained their proportionate amounts of total enrollments. (See Table VII) Somewhat successful efforts have been made to affect substantial increases in enrollments in Mathematics and Science in order to meet teacher shortages in these fields. These fields have been particularly attractive to men, however, the withdrawals for military service have defeated our purposes.

Table VIII - Analysis of Enrollment by Curricula for the Year 1942-1943

DEPARTMENT	YEAR IN COLLEGE					TOTAL	SEX	
	Jan. Fresh.	1st	2nd	3rd	4th		M	W
Business Education	5	23	29	7	18	82	21	61
English	10	38	41	13	40	142	13	129
Languages	3	22	23	3	21	72	15	57
Mathematics	9	34	17	4	21	84	28	56
Science	6	21	19	9	11	66	34	32
Social Studies	8	44	43	9	31	135	40	95
TOTALS	41	182	172	45	142	581	151	430

By combining the January, 1943, enrollments of freshmen with the regular first year enrollments in the above Table VIII, the following enrollments in majors result, Business Education - 28, English - 48, Languages - 25, Mathematics - 43, Science - 27, and Social Studies - 52, making a total of 223 in the freshman class. The enrollments in the sophomore, junior, and senior classes were 172, 45, and 142 respectively. It may be seen that if large entering classes are continued while the small junior and senior classes are graduated, the enrollment then will be approximately 800.

7. Accelerated Program

It has been the policy of the State Teachers College at Montclair to accept the accelerated program involving two semesters of 18 weeks each and one summer quarter of 12 weeks as a war emergency program. The college has recognized the shortage of teachers and wishes to make every effort to meet the demands within the State. In order to do this, it has encouraged all students in attendance during the regular year to attend during the summers and by attending three summers, get credit for an extra year and graduate at the end of three years. For various reasons, some students have found it impossible or impracticable

to give up their summers. Therefore, the undergraduate enrollment for the summer quarter has been approximately 51% of the regular enrollment. The following enrollment figures for the summer terms of 1942-1943 are as follows:

Summer of 1942 - Enrollment 393 or 61% of regular enrollment
Summer of 1943 - Enrollment 298 or 51% of regular enrollment

This accelerated program resulted in the graduation of 274 students during the past year inclusive of August, 1943. (January - 125, May - 33, August - 116). It is clear that frequent graduations have accelerated the drain upon the student enrollment. It has also placed an extra burden upon the staff and students of the college and since acceleration has not been accepted by all students, it has divided classes, caused a greater number of classes, and in some instances has been the cause of small classes. State authorities, including the Legislature, have recognized the problems which the accelerated program placed upon the colleges and have cooperated by way of providing extra money for the extra work.

8. Enrollment in the Graduate Division

All reports indicate that there have been marked decreases in college and university enrollments except in departments of engineering and medicine. In general, the greatest reductions have been made in graduate schools. This is because of the demands made by military and industrial services and to the difficulty in transportation.

Table IX - Enrollment for A.M. Degree and Number of Degrees Granted over Five Year Period.

YEAR	NUMBER OF MATRICULANTS	NUMBER RECEIVING A.M. DEGREE
1938-1939	434	60
1939-1940	472	72
1940-1941	489	76
1941-1942	435	66
1942-1943	374	32

The decreases during the past two years have been due to wartime causes - further decreases are expected.

The classification of candidates for the Master's degree is as follows:

Department	June 30, 1943
Integration	
Administration and Supervision	93
Personnel and Guidance	45
English	83
Social Studies	90
Mathematics	27
Science	30
Language	6
	374

9. Table X - Part-Time, Extension, and Summer Session

Part-Time and Extension Statistics

Year	Number Offered	Courses Given	Total No. Students	Total Number Registrations	Average Number Courses Taken Per Student	Average Number Registrations Per Course
1938 Fall	46	44	518	851	1.6	19.3
1939 Spring	65	57	606	940	1.5	16.5
1939 Fall	62	54	646	1035	1.6	18.9
1940 Spring	59	55	605	974	1.6	17.7
1940 Fall	57	45	523	770	1.5	17.0
1941 Spring	50	46	517	764	1.5	16.6
1941 Fall	47	43	532	786	1.5	18.2
1942 Spring	52	33	349	447	1.3	13.5
1942 Fall	35	23	311	453	1.4	19.9
1943 Spring	39	25	369	457	1.2	18.2

Summer Session Statistics

Summer of						
1939	122	100	601	1407	2.3	14.0
1940	126	90	503	1185	2.3	13.1
1941	98	73	442	983	2.2	13.3
1942	103	84	243	655	2.6	7.7
1943	95	78	182	470	2.6	6.0

The above Table X presents a combination of Part-Time and Extension data and Summer Session data. The data do not include accelerated students and therefore are related particularly to graduate enrollment and graduate work. (See Table IX). It has been difficult for graduate students to keep up attendance. Furthermore, advanced degrees may seem to some to be somewhat of a luxury during war times.

It will be noted that recent decreases are abrupt and that the college has endeavored to anticipate enrollments and has decreased its number of offerings accordingly. It is also anticipated that post-war demands for graduate work will increase rapidly and very likely the type of offerings will be changed somewhat. During the past two years, an effort has been made to carry on the prescribed degree work and to offer war-time courses for teachers in service. During the past year, over 230 students elected war-time offerings. Since some of the courses were supported by the Civil Aeronautics Administration, their enrollments of approximately 140 are not included in the above part-time data.

10. Totals - Enrollment and Graduates

The total enrollment (registration at close of the year) for the college including regular undergraduates, regular graduate students, summer session, part-time, and extension, and the demonstration high school for the year 1942-1943 was 1,607. The total for the previous year was 1,914 and the decrease is accounted for by the following data:

Table XI - Summary of Enrollment Data

Instructional Division	1938-39	1939-40	1940-41	1941-42	1942-43
Regular undergraduate	755	712	655	641	581
Regular graduate	29	35	17	7	-
Summer session	597	557	440	209	182
Part-time and extension	1124	1258	1040	881	680
College High School	184	184	188	176	164
Totals	2689	2746	2340	1914	1607

The above figures include duplicates. The reasons for decreases have been noted previously.

The total enrollment of the State Normal School from 1908 to 1930 was approximately as follows:

Graduates	3,921
Withdrawals	1,028
Total	4,949

Graduates and withdrawals from the State Teachers College from September, 1930, to June 30, 1943 were as follows:

Graduates with A.B. degrees	2,275
Graduates with A.M. degrees	479
Withdrawals	811
Total	3,565

B. Teacher Education at Montclair in Relation to War

The committee organizations on Montclair in relation to the war were carried over from 1941. (See Annual Report for 1941-1942) The scope and details of their work are shown in the report of Dr. Partridge, Chairman of the "Committee on Policies and Coordination" which follows.

MONTCLAIR STATE TEACHERS COLLEGE AND THE WAR

June 1, 1942-May 31, 1943

Introduction

This is a report of the impact of total war upon a State Teachers College engaged primarily in the task of preparing secondary school teachers for the state of New Jersey. The report covers the period from July 1, 1942 to June 30, 1943. This is the second progress report and has been prepared by the War Effort Advisory Committee at the request of the president of the college.

There are two angles from which the effect of the war upon the college might be described: 1. the contribution of the college to the war effort and 2. the adjustments necessary in the college program as a result of the war. By far the more important of the two is the first which represents the active, aggressive attempt of the institution and its staff to make a contribution is outside the regular line of duty or beyond the purpose of the college to train efficient teachers for the schools of the state. In other cases the most important, and yet least dramatic contributions are in the regular line of duty.

The continued and efficient operation of America's educational system is a vital necessity in total war. The technological society that man has created demands highly trained and intelligent personnel to keep it in operation. It is not an exaggeration to say that one generation without education would make the operation of our society as it is impossible. This implies that a continual flow of young people with technical and general training is absolutely necessary to the normal operation of our social structure, and in the time of total and mechanized war it is doubly important. Without an effective educational system the day would surely come when the machines of war would grind to a stop from lack of repair, the lines of production would slow and stop without intelligent and trained direction, the fields would grow over with weeds from lack of trained farmers to till the soil.

Education, then, is one of the first home fronts in importance and one of the most difficult to hold intact. The American schools have become so much a part of our national scene that they are taken for granted by the average citizen. Few people appreciate the problems of supply, personnel, transportation and administration that face the schools in time of war. American parents wave fondly good-by to their twenty-five million youngsters as they go off to school, confident that the schools will be there faithfully doing their duty come what may.

The most serious problem facing the schools is that of trained personnel. Teachers salaries, which are never great financial prizes, are far behind wages in industry in a war boom. The selective service system depletes the ranks of young teachers and teachers in training. These and other things combined gather momentum as the months pass and make it increasingly difficult for school administrators to find trained personnel. Thus one of the major functions

of a teachers college is to recruit teacher material and speed-up the training program as much as practicable in order that this teacher shortage can be minimized as much as possible.

The State Teachers College at Montclair has actively recruited students to fill the depleting ranks of high school teachers. This recruiting has taken the form of informal visits by staff members to nearby highschools where they conferred with students, talked with guidance counselors, left leaflets bearing information about the college. The results of these efforts have been encouraging in-so-far as women students are concerned. There had, as would be expected, been a considerable drop in the number of men students. It is possible too, that there had been some drop in the average ability of entering students since in normal times Montclair has enjoyed the position of choosing from a list n candidates longer than could be taken in.

The Accelerated Program.

Soon after the country went to war it became evident that a serious teacher shortage was in the offing. In an attempt to prepare for this shortage the state department urged the various colleges to develop a plan whereby teachers in training could prepare for their duties in a shorter period of time without sacrificing materially any of the course content.

By reducing vacation periods, starting a little earlier in the fall and offering an additional semester of work during the late spring and summer it became possible to accelerate the program of preparation to such an extent as to cover the course content in three years. This meant in turn that if the student body was to be maintained it would be necessary to recruit new students to enter the college whenever a new semester opened.

he accelerated program has brought with it the following adjustments:

1. The need for several graduations each year. With students entering each semester and with an additional semester of work during the summer it became necessary to hold commencement exercises three times a year in order to graduate the students who finished the course of study.

2. Considerable adjustment in teaching schedules and staff loads. There has been a tendence toward more but smaller classes. due to he need of offering more frequently subjects which in normal times were offered only once a year. This has increased problems of room assignments and staff teaching loads.

3. The re-arrangement of summer plans by staff members, sometimes at considerable personal sacrifice in order that the accelerated program could continue.

4. Issuance of emergency certificates to some students in order that they could fill teaching positions and return to the colleges during the summer term to conplete their academic work.

The effect of acceleration and the war generally upon enrolment

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

[illegible]

for the period covered by this report can be seen in the following figures:

	Men	Women	Total
Fall 1941	210	442	652
Feb 1943	151	430	581

By May 31, 1943 the number of men students had even further decreased due to induction into service. Approximately 60% of the students are on the accelerated program.

Guiding students into service.

One of the most significant and helpful services performed by the college was that of guiding students into the various branches of the service. The reserve programs of the Army, Navy and Marine Corps which were opened to college men made it necessary for some person on the staff to be designated to coordinate these programs in the college and advise students about entry into any of them.

Dr. O. C. Ingebritsen was designated by the president as chairman of the committee to handle this problem. The other members of the committee were C. E. Jackson and Dean C. W. Finley.

The committee set about immediately to gather information from the different branches of the service, to attend meetings in the area called by representatives of the services. Literature was assembled for distribution among the students and arrangements made to bring recruiting officers to the college to describe the advantages of their respective branches. In short, a serious attempt was made to acquaint the students with the paths that lay ahead so that they could make intelligent decisions. This, of course, entailed a great deal of individual counseling on the part of the members of the committee but it was a real service to the students and to the armed forces.

An interesting outgrowth of this scheme was the organization of a special graduate course in war-time guidance for counselors in nearby high schools. This course met a real need and attracted 23 students the first time it was offered. A brief description of the course will be found elsewhere in this report.

Special War Courses

All in all a surprising number of new courses have been organised at the college as a direct contribution to the war effort. The following list indicated the breadth of these new offerings:

Guiding High School Students into War Services. Spring, 1943 23 Students

This course is designed to cover the opportunities in the armed services and in industry in the war effort. The object is to acquaint high school teachers and guidance workers with the needs and opportunities and with the literature and other resources which may be used for guidance and orientation.

Artillery Mathematics. Summer, 1942 19 Students

This course deals with the applications of mathematics to the problems of field artillery and to problems of supply. Text:

Elementary Mathematics in Artillery Fire, J. M. Thomas.

Cryptology. Spring, 1943

New methods in Cryptology, or crytography, make use of elementary theory of numbers in forming codes and in the transmission of code messages. The above course deals primarily with this phase of cryptology.

Marine and Air Navigation.	Summer, 1942;	Fall, 1942;	Spring 1943
Students	34	19	17

The mathematics and practice of navigating ships and airplanes by dead reckoning and by piloting. The theory of the magnetic compass, gyro-compass, and celestial navigation. The theory of charts and maps used in navigation.

Teaching Mathematics in a War Program. Summer, 1942 10 Students

The study of high school mathematics with respect to its application to war and industrial needs. The reorganization of the curriculum to supply these needs.

Navigation. Spring, 1943 150 Students

Includes the following topics; the earth, map projections, map reading, dead reckoning, use of navigational computers and instruments.

Spherical Trigonometry. Spring, 1943 12 Students

Deals with the trigonometric solution of spherical triangles as related to the problem of great circle sailing. Includes solution of triangles using the slide-rule.

Introduction to Radio. Dec., 1942 20 Students

A course given for teachers of physics and industrial arts to prepare them to begin the teaching of a year course in New Jersey high schools in the field of pre-induction radio.

First Course in Aeronautics. Part I Summer, 1942 24 Students

This course was given for the first time in this college for any and all students who wished to study aviation. It covered the construction and operation of airplanes. Eleven students started primary flight instruction during the summer.

Science 100A Section I Spring, 1943 54 Students

The work of this section is devoted to 30 problems in the field of pre-flight aviation with applications to the school fields of mathematics, English, social studèes and science.

Special War Courses (cont.)

Science 100B Section II   Spring, 1943 49 Students

This section is devoted to radio broadcasting and the basic physics of radio receiver construction and operation. Reference readings include works in biography, school uses of radio, and international news and war broadcasts.

First course in aeronautics Sections I and II Fall, 1942 44 Students

Section I of this course deals with learning to Fly. Section II, given for the first time in the college, covered the elementary principles of aerodynamics for pre-flight aviation in high schools. Students in this section engaged in voluntary flight instruction out of college hours.

First course in aeronautics   December, 1942   66 Students

This course was conducted during the Christmas vacation for teachers in service. Most of these teachers were from the fields of science, mathematics, and industrial arts.

Pre-flight aviation.   Spring, 1943   146 Students

This course, conducted by the science, mathematics and geography departments is given for theCivil Aeronautics Administration to train aviation teachers for the high schools of New Jersey. Teachers spend 3½ hours at the college each of 18 Saturdays.

First Aid courses.

Several standard and advanced First Aid courses have been given during the past year. These meet the specifications of the American Red Cross.

Physiology of First Aid.   Fall, 1942   13 Students

A two-semester hour course so administered as to supplement standard first aid instruction with selected, detailed information concerning human physiology which makes first aid techinques more intelligible and therefore more effective. This course was devoted to lectures illustrated by a few demonstrations. The course was given for 15 weeks, a total of 30 hours.

Post-War Problems.   Summer, 1942   11 Students

About twenty recent books which deal with the psychological, economic, social, political and cultural conditions of a democratic peace were discussed.

Diplomatic History of the United States Summer, 1942, 12 Students

Mainly a lecture course, in which detailed information is given concerning the work of the State Department, the influence of the executive and the legislative branches as well a public opinion on U. S. foreign affairs.

Special War Courses (cont.)

The Far East. Spring, 1943 17 Students

A lecture course, in which a description of the Chinese and Japanese background is furnished. Special emphasis is given to those phases of Chinese history and thought which seem suitable heritage for merger with Western civilization.

British Empire in the Present Crisis Spring, 1943 12 Students

The course gives the philosophy of the Imperial relationship in the 20th century and how that was reached. It also deals with Canada in her American, Imperial, International relationships; with South Africa, New Zealand and it gives a survey of India with an analysis of the racial, religious, cultural, economic and political problems.

The role of Geography in World Affairs Today Fall, 1942 45 Students
(Offered in Rutherford Adult Education School)

The geographic influences on the nature and conduct of the present war. The reorganization of the world on the basis of self-sufficient geographic units.

Post-War Planning Spring, 1943 28 Students
(Offered in Rutherford Adult Education School(

The problems of writing the peace, demobolizing the Army, repairing the devastated areas, and reorganizing our world order.

Teaching of the Social Studies in the Present Crisis
Spring, 1943 20 Students

A composite course given by members of the Social Studies Department.

Contrasting Cultures of Today Summer, 1942 11 Students

This course aims to evoke the patterns of thinking and feeling which underly the conflicting cultures of today. Political events are looked upon as manifestations of basic tendencies which are more clear in the literature, fine arts, religion, philosophy and folklore of the peoples. The cultures studied are as follows: Russia, India, China, Japan, Totalitarian Italy and Germany, England, France and U.S.A.

The Economics of War Summer, 1942 Spring, 1943 66 Students

The economies of war and post-war planning with particular emphasis on the impact of war on production, consumption, exchange, finance and government control during and after the war.

War Languages Fall, 1942, Spring 1943 16 Students

Aural and Oral contact with about 20 foreign languages involved in this global war. Training in recognition of these languages and

Special War Courses (cont.)

elementary introduction to learning at least 10 through use of native speakers, Linguaphone disques, foreign newspapers, intensive phonetic training (IPA symbols).

Military Drill. (College and College High School) Fall and Spring
80 Students

Voluntary training. Regular military drill with customs of services, tactics, marchings, manual of arms, etc.

Democracy in American Drama Summer, 1942 15 Students

An historical survey of American drama to discover the seeds of democracy in characters and dialogue which have eventually flowered into a national expression.

Changes in existing courses.

In some subject-matter fields there has been considerable change in course content as a result of the war. In other areas there has been little or no change since the courses were not such as to need change. Some of the more significant changes in existing courses as reported by staff members are outlined below.

> New course outlines are in preparation for all college courses in biology, chemistry and physics.
>
> In Physics 402 (Electricity and Magnetism) stress has been placed in A.C. circuits as a foundation for radio communication theory for which many army enlisted men are being trained.
>
> Science 100B - the required course for all students now stresses human biology, food production, food values, digestion, nutrition, etc.
>
> Biology now includes detailed study of physiology of flight, physical requirements of air crews, effects of altitudes, acceleration, temperature change, etc.
>
> Science now includes study of strategic materials (largely mineral) of the war, their derivation and probable post-war realignments. Zoning of animal and vegetable resources, and relation to the war and world economy. Origin and comparison of races with reference to Hitler's race theories, "superior" races and other racial problems of the war and post-war settlements.
>
> Mathematic courses have been altered to aid men in enlisted reserves, giving them special training for military uses. Use of slide-rule is emphasized.

Social studies courses have been enlarged and revised to meet changing needs and conditions. Defense of Western Hemisphere is emphasized together with the role of American nations in the war. Post-war adjustments are discussed in many classes together with social problems arising out of the war.

History courses now include treatment of background of modern nations. The meaning of citizenship and democracy is stressed more. Additional stress on outstanding American leaders. Economic courses stress war economy.

Integration courses have stressed the High School Victory Corps program, especially with the Seniors who have come back from their student teaching.

In the psychology courses for undergraduates there have been special units on youth and the war and special emphasis given to guidance requirements of adolescents during the war period.

Graduate courses on curriculum construction have emphasized the changes due to the war.

The World Literature courses have spent some time surveying the literature of the conflicting cultures of the world today.

Methods courses in English now stress use of the bulletin boards in vitalizing modern literature and making graphic the needs of the times.

The Foreign Language Department has slanted its courses in the direction of the war effort by giving more emphasis to the history of the French Empire, weekly discussions in the French Classes about the role of France in the war. Inter-American friendship has been sponsored by visits of Montclair students to Canadian colleges and return visits by Canadian students.

Health and hygiene courses now stress first aid more than ever. All physical education for men has been shifted in the direction of pre-induction exercise and a testing program has been instituted to reveal the physical needs of the men students. Physical Education for women has been altered to meet the requirements of the Victory Corps program.

STUDENT WAR ACTIVITIES

(11/1/42 to 5/1/43)

The Student Government Association appointed a War Activities Committee which was very active during the winter months and the spring months. Below is a summary of what they accomplished.

1. Christmas Gift Boxes sent to all Montclair Men in service
    a. Two hundred boxes sent
    b. Each box included: 1 flat-fifty of cigarettes, 1 package chewing gim, one chocolate bar, one package of gum drops, one package of hard candy, and a greeting card.
    c. Money was collected by donations of $25 respectively from the four classes and the faculty.

2. Pearl Harbor Week
    a. Held during week of December 7.
    b. Special Assembly held
    c. Center Hall Booth set up for selling stamps and bonds.
    d. Inter-department and Inter-class leagues set up to stimulate purchases
    e. Goal set for: $250 in War Stamps
    f. Final result of student's sales: $484.75
    g. Faculty sales: $1402.75
    h. Total sales: $1887.50
    i. Winner of Inter-department competition: Social Studies Dept.
    j. Winner of Inter-class competition: Freshman
    k. Exhibit set up in center hall; posters placed around buildings; "league standing" posters placed in center hall; "Pearl Harbor Week" Banner placed in Center Hall; publicity in Montclarion.

3. Brotherhood Week
    a. Held during week of February 23
    b. Special Assembly held; three guest speakers
    c. "Brotherhood Week" film shown in Room 4.
    d. "Brotherhood Week" Banner placed in center hall; posters placed around building; publicity in Montclarion.

4. Scrap Drives
    a. Victory "V" key receptical placed in lower hall.
    b. Silk stocking recepticals placed in dorms.
    c. Two hundred wrought iron flower stands turned in
    d. Lipstick container receptical placed in center hall.
    e. Publicity by posters and Montclarion.

5. Miscellaneous Activities
    a. Organizing groups of girl dorm students to assist Red-Cross in bandaging at Mount Hebron School and Lower Montclair.
    b. Purchase of wooden rifles for military drill course; and supervision of course after departure of Captain Hamilton.
    c. Purchase of recording of last broadcast from Corregidor

which may be used by any campus organizations.
  - d. Arranging for reduced price tickets for "Town Hall" programs of Griffith Foundation on topics pertinent to War Effort.

6. Blood Bank
    - a. Assistance rendered to Red Cross in setting up facilities for the Blood Bank
    - b. Directory posters placed around building

7. Victory Book Drive
    - a. Approximately 125 books were collected and turned in

Physical fitness program.

The college could boast of an active and effective physical education program for its undergraduated before the war. The war crisis brought a need for a different and more vigorous type of training, expecially for the men. To meet this need several steps were taken.

A commando course using natural obstacles has been developed and is used regularly.

Military training in the form of drill was offered to men students in both the college and the high school.

Regular gym instruction was made more rigorous.

A physical fitness testing program was initiated.

Special emphasis on war service has been woven into the health courses.

Blood-Bank donations.

Through the efforts of Dr. Felix Wittmer the Red Cross sent a blood bank visit to the college on April 29, 1943 where students, staff members and residents of Montclair donated a total of 150 pints of blood. About 110 of these pints were form students and staff members.

Student Teaching

The problem of placing and supervising student teachers has been complicated from several different angles as a result of the war. First of all, due to the accelerated program it has been necessary to provide for sutdent teaching in the fall semester as well as the usual spring period. This has meant additional adjustments in teaching schedules on the part of the staff.

A second effect has been from the restriction on travel which has mede it difficult ot make the customary three visits to the teachers in training by both the Integration Department and the subject-matter department. Thus it has seemed wise to place the students nearer to the college and to curtail the number of visits to a total of four rather than the customary six.

Due to the accelerated program it has also been necessary to shorten the student teaching period slightly in order that the students could return to the college for a full six-weeks of courses as is the custom.

Air Raid Precautions

An institution involving several hundred students and staff members has a considerable responsibility to provide for the safety of those persons in case of an air-raid. To meet this responsibility a committee was appointed headed by Dr. Harley Milstead. This committee arranged for periodic air-raid drills and develope plans for evacuation of the buildings in case of fire and placing of personnel in relatively safe places in case of air-raid.

The dim-out regulations of this area are such as to require all shades to be drawn at a specified time each night. Enforcement of these regulations has necessitated a constant check on lighting conditions and closing after dark those areas of buildings that could not be shaded (the Library for example.)

Farm Labor

Repeated calls for help on the farm-labor front through the various news papers caused the members of the War Advisory Committee to caste about for some tangible contribution that the college could make to the growing problem. A call to the county agricultural agent of Passaic County revealed an acute labor shortage in the truck farms nearby the college. Arrangements were made for a committee of farmers to meet with faculty members and student representatives. At this meeting the difficulties of recruiting students for work were throoughly aired...the prospects did not look to good.

At the suggestion of the War Effort Advisory Committee the president appointed a committee of faculty and students consisting of Dr. Rufus Reed, chairman and the following members.. Dean Maude L Carter, Dr Claude Jackson, Dr Harry Snyder, Arthur Seybold from the faculty and the following students: Stanley Hardy, Janet Seider, and Kathering Perrine.

Inquiry among members of the student-body of the college and the College High School revealed a real interest in helping the farmers so a mass meeting was held in the gym where the farmers explained their plight and the students were invited to sign up for service. To this call more than 150 students responded including those from the highschool. Faculty members volunteered to go along and work with each squad and furnish transportation where it was needed. The students were organized according to the days they could work.

When weather permitted and there was a need for help a group of students, mostly women, rolled down to the truck farms nearby and made their contribution to the war effort by helping to raise food.. food that would help immediately to feed the city of New York. To many students the experience of helping to raise food was a new and unique experience. The amount of money earned was not great and the total number of working hours was small when compared with the vast need in the country. However the contribution was real and resulted up to the time of writing in more than 200 hours of labor.

The types of work in which students engage were planting, weeding, sorting and packing and harvesting.

Teaching Aids service

Both as a part of and in addition to the work of the War Information Center at the College there had been a considerable service to nearby schools and organizations in connection with the preparation of teaching aids, bibliographies, etc.

The following specific projects related to the war effort have been completed:

Bibliographies...

Education and National Defense
Civilian Morale
Post-war-Planning and the schools
Wartime Guidance for Students

Lists of teaching aids...

Flying and Weather
General Science
Gardening

Teaching aid lists in preparation...

Recreation
Business Education

The teaching Aids Service has made the following definite contacts in reference to war work:

Worked with U.S. Secret Service on spurious money and checks

Consulted with Dr. Kwin Wee Shaw on post war visual education in China.

Consulted with Adjutant General's office of the War Department on the use of right type of visual aid for training soldiers.

Consulted with Peliculas Educativas, Cuba, on setting up a film libary.

Consulted with Herbert D. Hall Foundation, Newark, on establighing visual aid programs in vocational high schools for pre-war training.

New York State Education Department, Bureau of Radio and Visual Aids, Albany: conference on how best to foster Victory Program.

Stromberg Carlson Telephone Manufacturing Co. Rochester, N.Y. How to spped up production by teaching employees with visual aids.

U.S. Office of Education, Visual Aids for War Training, Washington, advice on films.

U.S. Civil Service Commission, Washington asked for help on training films.

U.S. Department of Agriculture, office of Foreign Agricultural relations, Washington, asked advice on Latin American Visual Aids.

Teaching Aids Service (cont.)

U.S. Department of State, Division of Cultural Relations, Washington, Advice on Latin America.

U.S. Naval Training Station, Newport, R. I., advice on how to use visual aids to teach sailors mathematics.

War Department, Headquarters Army Air Forces, Washington, advice on existing visual aids for their use.

War Department, Office of Chief Signal Officer, Washington.

Etc.

Contributions of individual staff members

A considerable contribution is being made to the war effort by individual members of the staff as citizens in their own neighborhood and community. Many of these duties are such as any responsible member of society would assume, others a re directly related to the professional training or the position on the college faculty. It is hardly correct to list these as contributions of the college, but they do represent a part of the total picture of war activities, some of them closely related to the college program but all of them volunteer on the part of the staff member. No attempt will be made here to list them in order of importance, neither is there any claim that the list is complete.

Member War Policy Commission, National Council of the Social Studies

Taking courses in Russian and Arabic.

Gave demonstration of Judo methods.

Wrote Article on comparitive literature in the accelerated program.

Research statistician for Wright Aeronautical Corporation.

Chairman of Committee on War Information Center.

Preparing yearbook for National Council of Teachers of Math. dealing with multisensory aids for teaching math.

Compiled two bibliggraphies for aviation courses.

Wrote article on "Mathematics in War Program.

Member of state committee in Curriculum Adjustment in the Victory Corps and War Program.

Spoke over radio on dim-out regulations.

Speaker at institute on Latin and Defense.

Gave performance at Fort Dix for Fighting French Force Battalion.

Gave performance at New York University with officers and sailors of the "Richelieu"..for prisoners of war benefit.

Talked to Womens Clubs, service Clubs, P.T.A.s.

Directed School and College Civilian Morale Service under the State Department of Education, included preparation of material and many addresses.

Consultant to High School English Departments on revision of English courses of study for wartime.

N. J. Representative in contact with committee on planning the organization of Peace.

Member of National Committee on Pre-induction Courses in Mathematics for the Victory Corps Program.

Spoke to Section 19, N. Y. Society for the Experimental study of Education, Bayonne Teachers, N. J., N. J. Association of Mathematics Teachers.

Prepared Algebra text for use by the Armed Forces Institute.

Counseled with students and teachers on mathematics course content.

As volunteers in local defense:

Deputy air warden.
Teaching first-aid course.
Member of Red Cross first-aid group.
Deputy fire chief, auxilliary fire department.
Blood donor.
Taught courses in trigonometry and slide-rule.
Nursing Committee, local hospital.
Local victory garden committee.
Local committee for issuing ration books.
City controller for civilian defense.
Making surgical dressings.
Member physical fitness committee of town.
In charge of city civilian defense education committee.
Surpervisor of student farm work.
Taught course in mental hygiene to nurses in training.

Conclusion.

One cannot help but be impressed with the fact that the contribution to the general war effort of an institution like the Montclair State Teachers College can be broad and varied. Nearly every phase of its program has been influenced to some extent. In addition to the main task of preparing teachers to fill the growing demand a variety of other services are being performed by the institution, its individual staff members and students.

Noteworthy developments were made by the committee on "Current and Post-War Adjustments" which made two important reports, and by the library's "Key Center for War Information" which has collected and classified a great quantity of valuable materials from about 200 state, national, and foreign bureaus, associations, and agencies. Bulletins describing the materials and services of the bureau to the schools, clubs, etc. of northern New Jersey have been published and circulated. Exhibits have been prepared and speakers from the Speakers Bureau have been made available.

Record should also be made relative to the work of the committee on "War Service Guidance" which has collected material relative to the types and conditions of service in the Army, Navy, Marines, and war industries. This committee has provided, through group meetings and individual counselling, personal guidance to young men of the college whose cases were up before the draft boards or who wished to enlist. The committee has made it possible for men students with special qualifications to find the most appropriate and effective ways of rendering war service. Up to the beginning of the present college year, the college had 393 men and 22 women in military service. The Alumni, through the college personnel office, have maintained various types of contacts with graduates in service throughout the year. This has included systematic correspondence, publication and circulation of service bulletins, Christmas gifts, etc.

An extension course for high school teachers in service has been organized and given by Dr. Ingebritsen under the title of "Guiding High School Students into War Services".

During the year 1941-1942, a total of 43 special war-time courses were offered to undergraduate students, graduate students, and teachers in service. (See Annual Report for 1941-1942, pages 6 and 7) The following courses with special war-time interest were offered during the year 1942-1943

Literature for Adolescents; Developing Faith for Living Through Literature
American Literature: A Pageant of American Democracy
Contribution of American Drama to American Democracy
Conflicting Cultures in Contemporary Life
English Literature and the Rise of Modern Democracy
Meteorology
Geography of Africa, Australia, and New Zealand
Economic Geography of South America
Economic Geography of Asia and the East Indies
Economic Geography of Caribbean America
Practical Avigation and Navigation
Artillery Mathematics
Teaching Mathematics in a War Program
Defense Mathematics of the Shop and Industry
Administration and Supervision of Mathematics in a War Program
Differential Equations with Applications to Ballistics and Engineering
Cryptology, Codes, and Code Messages
Statistics in Government and Industry
Elements of Navigation for Junior and Senior High School Classes
War Languages: A Practical Approach to Any Language

First Course in Aeronautics
Introduction to Radio Communication
Aeronautics I: Learning to Fly
Second Course in Aeronautics
Aeronautics: Avigation
Aeronautics: Aerodynamics and Aircraft Engines
Food and Nutrition in Defense
Astronomy for Navigation
Physiology of First Aid
Biological Technique: Basic Preparation for Laboratory Service in Military Hospitals
Meteorology with Applications to Aviation
Contemporary World Affairs
Development of South and Central America
Current and Post-War Problems in Economics and Government
Diplomatic History of the United States
Recent Trends in American History
The Far East
Teaching the Social Studies in the Present Crisis
The British Empire in the Present Crisis
Advanced First Aid and Home Nursing
Recreational Leadership in War-Time
School Health Service Program
Guiding High School Students into War Services
Secondary School Physical Fitness Program for War-Time

The college has had the satisfaction of giving significant aid to teachers in service by offering practically free of charge courses in aviation and radio and the Civil Aeronautics Administration courses in "Pre-Flight Aeronautics for Teachers". The first courses were organized and given by the college during the fall semester and also each day during the Christmas vacation. The C.A.A. courses were given under the direction and support of the U. S. Department of Commerce. These courses were given on Saturdays from 9 A.M. to 4 P.M. beginning January the 23rd and extending to May the 29th.

Teachers in service numbering 146 were in regular attendance. The course descriptions and other instructions follow:

DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION

Course Outline
Pre-Flight Aeronautics Course for Teachers

GENERAL INFORMATION

Scope of Course - A total of not less than 54 or not more than 64 hours of classroom instruction shall be provided for each Secondary School Teacher as follows:

	Hours	
	Minimum	Maximum
Introduction to Pre-Flight Aeronautics	1	1
General Servicing and Operation of Aircraft	17	19
Meteorology	15	18
Navigation	13	15
Civil Air Regulations	5	7
Pre-Flight Aeronautics in the Secondary Schools	1	2
Final Examination	2	2
TOTAL	54	64

Study References and Textbooks - The recommended study references include selected Civil Aeronautics Bulletins in the several subjects, five widely used textbooks, special bulletins, and other references which are listed hereinafter. The Civil Aeronautics Bulletins shall be the basic guides to be used by the instructor in the course. Each Secondary School Teacher should procure a copy of the textbook from which he is teaching or from which he will teach in a secondary school, in order to follow it throughout the study of the four principal subjects of the course.

Laboratory and Field Studies - Each institution shall be expected to make available any of its demonstration equipment which is appropriate for use by the class. Visits to airports or other centers of aeronautical activity are helpful and should be made where feasible, although such visits may not be made during the hours scheduled above and are not subject to Federal reimbursement.

Examinations - Nine class periods have been allowed in the schedule for examinations and review of examinations during the course. The final examination shall cover all the subjects and shall be given at the end of the course. All examinations shall be prepared and graded by the instructor of the course, but shall be subject to review upon request by the Civil Aeronautics Administration. Appropriate credit should be given by the contractor to students who pass the course.

COURSE OF STUDY
Recommended Breakdown of Pre-Flight Aeronautics Subjects
By Hours

I. Introduction to Pre-Flight Aeronautics . . . . 1 hour
Purpose: To outline the scope of the course and provide general orientation for it.

The first class hour should be used for a preview of the course; organization, purposes, methods to be used, textbooks, and orientation in the historical background of aviation and aviation education. A selected bibliography of collateral references which will be found at the end of this Course Outline should be introduced, along with other suitable materials for study which may be available.

COURSE OF STUDY (CONT'D)

II. General Servicing and Operation of Aircraft . . . . 19 hours*

(Includes aircraft structures, aerodynamics, engines, instruments, and parachutes)

Purposes:

(1) To provide secondary school teachers with a more adequate knowledge of the aeronautical subjects listed above.

(2) To improve the quality of the teaching of these phases of pre-flight aeronautics in secondary school classes.

1st hour: Stresses on the aircraft structure.
2nd hour: Control surfaces and operation of controls.
3rd hour: Scientific principles underlying lift.
4th hour: Forces on the wing.
5th hour: Factors affecting lift.
6th hour: Power and drag.
7th hour: Propellers.
8th hour: Longitudinal stability.
9th hour: Lateral and directional stability.
10th hour: Climbing and gliding flight, taking off and taxiing.
11th hour: General principles of aircraft engines, aircraft engine requirements and types.
12th hour: Aircraft engine construction.
13th hour: Aircraft engine cooling, lubricants and lubrication systems.
14th hour: Fuels and principles of carburetion.
15th hour: Principles of ignition.
16th hour: Aircraft engine instruments.
17th hour: Use and care of parachutes.
18th hour: Examination.
19th hour: Review of examination.

Study References

Aviation Education Research Group, Teachers College, Columbia University, Science of Pre-Flight Aeronautics for High Schools, Macmillan, New York, 1942, $1.32, pages 40-68; 136-145; 192-213; 222-231; 235-279; 288-303; 304-309; 311-426.

Aviation Education Research Group, Teachers College, University of Nebraska, Elements of Pre-Flight Aeronautics for High Schools, Macmillan, New York, 1942, $.96, pages 54-57; 154-172; 176-179; 183; 185; 188-275; 361-364.

Hamburg, Merrill, and Tweney, George H., American Student Flyer, Pitman, New York, 1942, $1.50, pages 19-53; 117-146; 156-162; 171-172; 177; 182; 185-194; 204-225; 233-317; 326-332.

Pope, Francis, and Otis, Arthur S., Elements of Aeronautics, World Book, Yonkers-on-Hudson, 1941, $2.00, pages 1-18; 29-66; 97-235.

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* The course is outlined according to the maximum number of class periods allowed. Where less than 64 class periods are used, adjustments of time should be spread over the four principal subjects of the course. Total number of periods shall not be less than 54.

Study References (Continued)

Shields, Bert A., Air Pilot Training, McGraw-Hill, New York, 1942, $3.50, pages 16-42; 51-88; 96-97; 107-113; 114-117; 135-137; 143-170; 171-172; 177-183; 184-185; 189; 206-226; 240-254; 266-283; 284-287; 288-294; 301-305; 324-345.

Civil Aeronautics Bulletin No. 22 Digest of Civil Air Regulations for Pilots, 1942, 6th ed., $.20*

Civil Aeronautics Bulletin No. 23 Civil Pilot Training Manual, 1941, 2nd ed., $.65

Civil Aeronautics Bulletin No. 27 Pilots' Airplane Manual by N.O. Anderson, 1940. $.30

Civil Aeronautics Administration, War Training Service, Daily Flight Inspection Record, Form 526. This form should be used by the Secondary School Teacher in connection with an inspection of an aircraft, wherever it is possible to make such an inspection. Copies may be obtained from the Director, Pre-Flight Aeronautics Program, C.A.A., Washington, D.C.

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*Civil Aeronautics Bulletins are available through the Superintendent of Documents, Government Printing Office, Washington, D.C. (Remittance is required in advance.)

III. Meteorology.

Purposes:

(1) To teach the essentials of meteorology as applied to aviation.

(2) To improve methods of teaching the meteorology of pre-flight aeronautics in secondary school classes.

1st hour: The importance of weather to flying; safety in war time and peace time; weather service available to pilots; classification of weather reports.
2nd hour: Conditions of the sky. Definitions of meteorological elements; pressure--how measured; types of barometer and application to the altimeter.
3rd hour: Humidity, wind, ceiling, precipitation.
4th hour: Weather maps and meaning of weather map symbols. Continue study of weather map symbols.
5th hour: Decoding of teletype sequence reports.
6th hour: Distribution of oxygen with height in the atmosphere--temperature and pressure variation with height.
7th hour: Specific humidity--condensation--heat energy in the atmosphere.
8th hour: Lapse rates--normal, dry adiabatic, and saturation adiabatic.
9th hour: Pressure gradient--centrifugal force--circulation of the atmosphere in high and low pressure areas.
10th hour: Air masses. Modification of air masses.
11th hour: Fronts.
12th hour: Weather associated with warm and cold fronts.
13th hour: General and local circulation of the atmosphere.
14th hour: Fog and low stratus clouds. Thunderstorms.
15th hour: Icing conditions.
16th hour: Weather map study.
17th hour: Examination.
18th hour: Review of examination.

Study References

Aviation Education Research Group, Science of Pre-Flight Aeronautics for High Schools, pages 436-583; 588-623.

Meteorology
Study References (Continued)

Aviation Education Research Group, Elements of Pre-Flight Aeronautics for High Schools, pages 53; 60; 68-138.

Hamburg and Tweney, American Student Flyer, pp. 345-450.

Pope and Otis, Elements of Aeronautics, pages 402-407; 423-527; 546-565.

Shields, Air Pilot Training, pages 356-434.

Civil Aeronautics Bulletin No. 25 Meteorology for Pilots by B.C. Haynes, 1940. $.75 (The revised bulletin is scheduled for publication, March 1, 1943.)

IV. Navigation . . . . 15 hours

Purposes:
(1) To teach the essentials of air navigation as used in piloting and dead reckoning.
(2) To improve methods of teaching air navigation in pre-flight aeronautics in secondary school classes.

1st hour: Introduction to maps and charts. Definitions, types of charts. The earth. Types of projections. Measurement of distances and distortion.
2nd hour: Lambert conformal conic projections. Measurement of course and distances. Map reading practice. Recognition of objects on ground indicated by symbols on chart. Chart symbols, location of objects, and terrain features on maps and charts.
3rd hour: Measurement of courses and bearings. True course, compass course, and magnetic course. Variation and deviation. Airspeed meter, description and purpose. Altimeter, description, purpose, and methods of setting.
4th hour: Magnetic compass; principles of construction and operation, compass errors. Problems in correcting for compass errors.
5th hour: Vector problems. Definition of vector. Triangle of velocity. The effect of wind; solution of problem where true course, airspeed, wind force, and wind direction are known, and ground speed and true heading are required.
6th hour: Solution of problems where wind vector, heading, and airspeed are known and true course and ground speed are required. Vector problems where any four elements are known and the remaining two elements are required.
7th hour: Introduction to dead reckoning; theory of dead reckoning navigation; time, speed, distance relationships. Calculations and estimated time of arrivál as an aid to map reading and pilotage.
8th hour: Simulated flight problems. Plan triangular course, using sectional chart.
9th hour: Solution of time, speed and distance problems.
10th hour: Solution of problems on returning to intended track.
11th hour: Solution simple radius of action problems.
12th hour: Time and time zones. Practice in solving all types of velocity triangle problems.
13th hour: Contact flight planning.
14th hour: Examination.
15th hour: Review of examination.

-Navigation-
Study References.

Aviation Education Research Group, Science of Pre-Flight Aeronautics for High Schools, pages 662-710; 714-725; 727-764.

Aviation Education Research Group, Elements of Pre-Flight Aeronautics for High Schools, pages 56-58; 329-360; 370-385.

Hamburg and Tweney, American Student Flyer, pages 451-500; 525-534.

Pope and Otis, Elements of Aeronautics, pages 287-334.

Shields, Air Pilot Training, pages 437-463; 467-494.

Civil Aeronautics Bulletin No. 24 Practical Air Navigation by Thoburn C. Lyon, 1940, $1.00.

Aeronautical charts. Regional and sectional charts, ordinarily procurable from the Chart Division, United States Coast and Geodetic Survey, are not available during the war period. The Coast and Geodetic Survey, Washington, D.C., has prepared for educational purposes a special chart, based on a portion of the Des Moines area five duplicate charts appearing on the one sheet cost $.25

Brown, Lois, and Jackman, E. V., Aeronautical Study Chart, Ginn & Co., $.40

V. Civil Air Regulations . . . . 7 hours.

Purposes:
(1) To teach the secondary school teachers how strict observance of air traffic regulations will lead to more safe and efficient flight.
(2) To stress contact flight and instrument flight rules and to explain the importance of traffic patterns.
(3) To improve methods used in teaching civil air regulations in pre-flight aeronautics classes in secondary schools.

1st hour: Introduction - Civil Aeronautics Act of 1938. Need for regulation. Methods of increasing safety.
2nd hour: Specially designated areas. Aircraft registration and certification. Transfer of title.
3rd hour: Pilot regulations, certificates, ratings and requirements. Airmen rating records and airmen identification cards. Issuance, duration and validity of pilot certificates. Definitions and penalties. (Civil Aeronautics Act of 1938. See Title 9)
4th hour: Importance of observing Air Traffic Rules especially regarding instrument flight. Flight rules. Contact procedure for taking off and landing; right-of-way; acrobatic flight rules; parachutes.
5th hour: Rules regarding traffic patterns. Light and signal rules; specially designated areas; control zones of intersection; control airports and control zones; danger zones.
6th hour: Weather minimums; contact and instrument flight; procedures and phraseologies for airport traffic control.
7th hour: Examination. Review of examination.

-Civil Air Regulations-

Study References

Aviation Education Research Group, *Science of Pre-Flight Aeronautics for High Schools*, pages 149-177.

Aviation Education Research Group, *Elements of Pre-Flight Aeronautics for High Schools*, pages 46-49.

Hamburg and Tweney, *American Student Flyer*, pages 591-601; 610-627.

Pope and Otis, *Elements of Aeronautics*, pages 566-570; 589-604.

Civil Air Regulations, Part 20, *Pilot Certificates*, Effective Sept. 1, 1942, for sale by Superintendent of Documents, Washington, D. C., (U.S. Government Printing Office) 10 cents., secs. 20.1-20.13; 20.3-20.37; 20.5-20.650; 20.71-20.721; 20.727-20.7271; 20.73-20.8*

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* Because these documents are the most current compilations of Civil Air Regulations, they should be given more study than other sources.

Civil Air Regulations, Part 60, *Air Traffic Rules*, as amended to July 15, 1942, for sale by Superintendent of Documents, Washington, D.C. (U.S. Government Printing Office) 10 cents, secs. 60.0-60.4711; 60.6-60.733; 60.8911; 60.90-60.912; 60.95-60.974*

Civil Aeronautics Bulletin No. 22 *Digest of Civil Air Regulations for Pilots*, 6th edition, August 1942, $.20.

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* Because these documents are the most current compilations of Civil Air Regulations, they should be given more study than other sources.

VI. *Pre-Flight Aeronautics in the Secondary Schools* . . . . 2 hours

Purposes:

(1) To evaluate the educational significance of pre-flight aeronautics instruction in the secondary schools.

(2) To seek practicable solutions for the principal administrative and instructional problems in secondary school courses in pre-flight aeronautics.

Study References

These references will be supplied by the Civil Aeronautics Administration on or before May 15, 1943, without special requests from institutions which offer the courses.

VII. *Final Examination* . . . . 2 hours

This examination should cover all topics of the course.

SELECTED REFERENCES

I. Books.

General Servicing and Operation of Aircraft

Chatfield, Charles H., Taylor, C.F., and Ober, Shatswell, The Airplane and Its Engine, 4th ed., New York, McGraw-Hill, 1940, 414 pages, $3.00.

Flight Preparation Training Series, Principles of Flying, New Yrok, McGraw-Hill, 1943, 360 pages, $1.50.

Flight Preparation Training Series, Operation of Aircraft Engines, New York, McGraw-Hill, 1943, $.90.

Gillmer, Thomas C., and Nietsch, Herman E., Simplified Theory of Flight, New York, Van Nostrand, 1941, 162 pages, $2.00.

Lee, John G., Fighter Facts and Fallacies, New York, William Morrow & Co.,Inc., 1942, 63 pages, $1.25.

Shields, Bert A., Principles of Aircraft Engines, New York, McGraw-Hill, 1942, 378 pages, $1.88.

Meteorology

Humphreys, W.J., Ways of the Weather, Pennsylvania, The Jaques Cattell Press, 1942, 400 pages, $4.00.

Vetter, Ernest G., Visibility Unlimited, New York, William Morrow & Co., Inc., 1942, 346 pages, $3.50.

Wenstrom, William H., Weather and the Ocean of Air, Boston, Houghton-Mifflin, 1942, 484 pages, $4.50.

Navigation

Flight Preparation Training Series, Air Navigation, including Part II- Introduction to Navigation; Part I - Introduction to Earth; Part III - Dead Reckoning and Lines of Position; Part IV - Navigation Instruments; Part V - Relative Movement; Part VI - Contact Flying; Part VII - Nautical Astronomy and Celestial Navigation, New York, McGraw-Hill, 1943, $1.00 each volume (tentative price)

Weems, Philip V.H., Air Navigation, 2nd ed., New York and London, McGraw-Hill, 1938, 537 pages, $5.00.

General Reference

Aviation Education Research Group, Teachers College, Columbia University, Air-Age Education Series, Bibliography of Aviation Education Materials, New York, Macmillan, 1942, $.88. This book lists numerous sources where useful free or inexpensive materials may be obtained for class use, as well as complete lists of books, periodicals and films.

Bartlett, Hall, Air-Age Education Series, Social Studies for the Air Age, New York, Macmillan, 1942, 180 pages, $.60.

Baughman, Harold E., Aviation Dictionary and Reference Guide, 2nd ed., Calif., Aero Publishers, 1942, 906 pages, $6.50.

General Reference (Continued)

Clevenger, Cloyd P., *Modern Flight*, New York, Noble and Noble, 1941, 594 pages, $2.95.

Flight Preparation Series, *Physics Manual for Pilots*, New York, McGraw-Hill, 1943, 229 pages, $.90

Flight Preparation Series, *Mathematics for Pilots*, New York, McGraw-Hill, 1943, 159 pages, $.60

Frederick, John H., *Commercial Air Transportation*, Chicago, Irwin, 1942, 493 pages, $4.00

Johnston, S. Paul, *Horizons Unlimited*, New York, Duell, Sloan and Pearce, 1941, 346 pages, $3.75

Jordanoff, Assen, *Your Wings*, New York, Funk and Wagnalls, 1940, 282 pages, $2.50

Jordanoff, Assen, *Jordanoff's Illustrated Aviation Dictionary*, New York, Harper & Bros., 1942, 415 pages, $3.50

Renner, George T., Air-Age Education Series, *Human Geography in the Air Age*, New York, Macmillan, 1942, 252 pages, $.64

Winter, William J., *The Model Aircraft Handbook*, New York, Crowell, 1941, 292 pages, $2.00

II. Periodicals.

Current Aviation. American Education Press, Inc., 400 South Front Street, Columbus, Ohio, and 580 Fifth Avenue, New York. Weekly during school year. 35¢ per semester, 70¢ per year, in clubs of 30 or more; 40¢ per semester, 80¢ per year, in clubs of 10 to 29.

Civil Aeronautics Journal. Civil Aeronautics Administration, Washington, D.C., Semimonthly 50¢ per year. Sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

C. Buildings and Grounds

In accordance with previous plans calling for additional office space, the following changes in office facilities have been provided:

1. The Dean of Instruction's office was moved from the room between room 5 and the present Personnel office to the room adjoining the President's office.
2. The Registrar's office which was located between the old Dean of Instruction's office and the present Dean of Women's office, was moved to room 7 and new and additional facilities were provided.
3. The office of the Secretary of Part-Time, Extension, and Summer Session was moved from the room between the office of the President's secretary and old room 7 to a newly adapted room between the new Registrar's office and room 8.
4. The office of the Director of Personnel was moved from the Dean of Women's office to the old Registrar's office.

The above changes have brought together and provided easy circulation between offices carrying on closely related work.

D. Staff Changes

A record should be made that four major changes were made in the college staff during the year.

1. Dean Charles W. Finley has retired and his place has been filled by the appointment of Dr. Thomas Clark Pollock.
2. Professor Roy W. Hatch, Head of the Department of Social Studies, retired at the end of the year. His position was filled by the appointment of Dr. W. Harry Snyder.
3. Mrs. Maude L. Carter, Dean of Women, died during the first of May and her position was filled by the appointment of Miss Margaret A. Sherwin.
4. Dr. Heber H. Ryan, Head of the Department of Integration, resigned to become Assistant State Commissioner in charge of Secondary Education. His position has not been filled to date.

Special attention is called to the above because of the important services which these staff members have rendered to the college over a period of years.

New Appointments to the Faculty

De Veritch, Victor	Part-Time Instructor in Violin
Glover, J. Howard	Instructor in Physical Education
Greer, Gladys	Assistant Instructor in Science
Hogan, James	Part-Time Instructor in Business Education
Placek, George S.	Instructor in Science
Ramsden, Ethel J.	Instructor in Science

New Office Staff Members

Van Etten, Frances	Assistant Registrar

Withdrawals from the Faculty

Brinley, Eldon D.	Instructor in Physical Education
Carter, Maude L.	Dean of Women
Finley, Charles W.	Dean of Instruction
*Glover, J. Howard	Instructor in Physical Education
Greer, Gladys	Assistant Instructor in Science
*Hamilton, W. Paul	Associate Professor of English
Hatch, Roy W.	Head of Social Studies Dept.
Hogan, James	Part-Time Instructor in Business Education
*Placek, George S.	Instructor in Science
Van Hoy, Helen S.	Instructor in Science

* Military Service

Withdrawals from Office Staff

Meller, Frances	Secretary to the Registrar

E. Faculty Preparation

Academic Qualifications of Full-Time Faculty over Five Year Period

Degree	Per Cent of Faculty				
	1938-39	1939-40	1940-41	1941-42	1942-43
Doctor's degree or equivalent preparation	42.7%	46%	50%	55%	52%
60 semester-hours of graduate study	25.3	22	24	18	23
Master's degree or equivalent preparation	30.3	30	24	25	23
Bachelor's degree	0	0	0	0	0
M.D. degree	1.7	2	2	2	2

III. Recommendations

1. That the college should make special efforts to recruit students for admission in January, May, and September in order to meet teacher shortages and to maintain the organization within the college which has been built up over a considerable term of years.

2. That the college, State Department of Education, and the special post-war planning commissions should plan definitely and be ready to promote vigorously a program of building construction for the State Teachers College at Montclair. Complete plans and specifications for a new auditorium and classroom building are on file. Since the State appropriation for this building was rescinded just at the time contracts were to be let, this project should be understood as having priority. I should also call attention to the fact that the following buildings have been recommended over a period of fifteen years and are listed

under "reserve building projects for favorable consideration".

A. Science and Mathematics Building

B. Physical Education and Health Building

C. Men's Dormitory

Preliminary plans are on file at Trenton for each of the above.

3. That the following recommendation quoted from the Annual Report for last year applies to the salary situation now.

"From time to time, data has been submitted relative to salary increases for staff members. It is obvious in these days of increased cost of living and increased taxes that comparatively low salaried people who, because of their professional status, are required to maintain a relatively high standard of living are faced with exceedingly difficult financial problems. In industry and commerce the need for salary increases has been faced realistically and satisfactorily. I can say without hesitation that in all my relations with teachers, I have never once seen them confronted with such exceedingly difficult financial problems. Well trained, progressive, experienced, and successful teachers are facing problems such as losing their homes, going through bankruptcy, increasing indebtedness, selling their insurance, and suffering privations not common in these days. Resultant despair and emotionalism has interfered with their morale and accomplishments. I respectfully recommend that the Governor and Legislature find ways and means of providing salary increases."

4. That attention be called to the recommendations of various departments relative to changes in courses of study and curricula. The college through its various offices, committees, and staff members should, insofar as possible, comply with all well approved recommendations and contribute its best services to the winning of the war.

5. That the college endeavor to have some constructive plans for meeting the possible educational adjustments which may follow the war.

IV. Statistical Data Which Have Been Carried by the Annual Reports over a Long Period of Years

A. Financial Statement

	1942-1943
Income	
From student fees	$ 64,202.02
From appropriations - public agencies	$272,255.48
Total	$336,457.50
Expenditures	
Personal service (salaries and wages)	$250,123.88
Maintenance and operation	$ 42,383.37
Total	$292,507.25
Student Aid	
Total loans made to students	$ 2,809.50
Total scholarships awarded to students	$ 8,310.00
Total Federal work grants to students	$ 2,432.87
Total	$ 13,552.37

B. Financial Aid and Scholarships

	Number		Value	Totals
Scholarships				
State	79		$8,310.00	
Edward Russ	2		150.00	
Howe Memorial	2	77	257.00	$8,717.00
Loans				
State	35		2,809.50	
Chapin Memorial	2	37	212.50	3,022.00
N.Y.A.	61	61	2,432.87	2,432.87
Student Jobs				
Fellowships	2		1,025.00	
Laboratory Assistants	14		975.00	
Waitresses	73		4,946.00	
Office and Misc.	30	119	611.68	6,343.48
Totals		300		$20,525.35

C. Distribution of Enrollment by Counties 1942-1943

County	Men	Women	Total
Atlantic	3	1	4
Bergen	19	38	57
Burlington	-	2	2
Camden	1	5	6
Cape May	1	1	2
Cumberland	-	5	5
Essex	69	176	245
Gloucester	-	2	2
Hudson	14	48	62
Hunterdon	-	-	-
Mercer	-	1	1
Middlesex	2	6	8
Monmouth	5	11	16
Morris	4	13	17
Ocean	-	4	4
Passaic	20	70	90
Salem	-	1	1
Somerset	5	6	11
Sussex	-	4	4
Union	6	35	41
Warren	-	3	3
Out of State	-	-	-
Totals	149	432	581

D. Analysis of Enrollment by Curricula 1942-1943

Department	Year in College						Sex	
	Jun.Fresh.	1st	2nd	3rd	4th	Total	M	F
Business Education	5	23	29	7	18	82	21	61
English	10	38	41	13	40	142	13	129
Foreign Languages	3	22	23	3	21	72	15	57
Mathematics	9	34	17	4	21	84	28	56
Science	6	21	19	9	11	66	34	32
Social Studies	8	44	43	9	31	135	40	95
Totals	41	182	172	45	142	581	151	430

E. Distribution of Graduates Including January, May, and August Graduations

For Secondary Teachers		Not Previously Eligible for Certification		Previously Eligible for Certification		Totals	
		Men	Women	Men	Women	Men	Women
Administration & Supervision	A.M.	-	-	7	1	7	1
Business Education	A.B.	16	19	-	-	16	19
English	A.B.	5	62	-	-	5	62
	A.M.	-	1	1	4	1	5
Foreign Languages	A.B.	10	32	-	-	10	32
	A.M.	-	-	-	3	-	3
Mathematics	A.B.	12	24	-	-	12	24
	A.M.	1	-	-	-	1	-
Science	A.B.	13	15	-	-	13	15
	A.M.	-	-	1	2	1	2
Social Studies	A.B.	22	44	--	-	22	44
	A.M.	-	1	2	3	2	4
Personnel & Guidance	A.M.	-	-	2	3	2	3
Totals		79	198	13	16	92	214
Graduate Curricula						14	18

ANNUAL REPORT OF THE
DEAN OF INSTRUCTION
1942-1943

The College and the War

You will receive a full report of this activity from our special committee in charge of such work. Special mention is made of it here because of its outstanding effect on almost everything connected with thetduties of this office and because of the major importance given it for the year just past. Since the start of the war we have made fundamental changes in our required courses, in the substitution of courses for those usually required and in the content of all our courses. Then, too, we have so administered our schedule that all male students can secure a full year's work in Mathematics and in Science, regardless of the field in which they wish to specialize.

We adopted the accelerated program plan very soon after it was approved by the State Board. As you already know, it resulted in our graduating three groups this year, one in January, One in May, and one in August. This acceleration seems to have been more than ample in meeting the increased needs of English and Social Studies teachers, but has failed to furnish enough Science and Mathematics teachers.

This change of pace in our schedule has been of great help to many of our men in securing special assignments in various departments of our armed forces. Now that the armed forces are inducting the men at an earlier age and are discontinuing some of the college programs of training,

the accelerated schedule has lost much of its value to our male students. In fact, our male to female student ratio is dwindling with each successive class. In the group admitted for September it is 1 to 10. It now seems that so far as male students are concerned, there is little need for the continuance of schedule adjustments. These adjustments are of little or no practical value to women in preparation for war service.

The so-called experts vary widely in their guesses as to the date of the ending of the war. The present condition of affairs with the Axis powers seems to warrant a guess that the strife will be over long before our next entering class graduates. It might be well to consider the abandonment of the accelerated plan before the admission of the 1944 group.

We have received inquiries about matriculation from men in service. The rigors of army life will do much to crowd out scholastic matters, hence the requirement of the entrance test for them would perhaps be unjust, and no doubt would be a handicap. Could service men (high school graduates) be admitted on probation without entrance examinations?

It is a natural consequence that desire for war service should reach the women of our student body. Several have already joined or applied for membership in the WAVES, WACS, and Marines. You and I have consistently pointed out to these girls that it is perhaps more patriotic and more necessary that they teach rather than join these organizations. A staff meeting devoted to this issue might result in a concerted action of faculty members to save our women graduates for the teaching profession.

Judging from reports throughout the nation, our college has been exceptionally fortunate in keeping up its enrollment. In times past we have been able to secure a highly selected freshman class, due to the fact that three times as many students applied for admission as could be accepted. In the last two years we have accepted practically all who applied. As would be expected, this has resulted in a lower average ability in the student body. The staff members seem to be unanimous in their belief that it has resulted in a lowering of our standards in quality and quantity of work done. This seems to be a natural consequence of the war, one that will be corrected if and when the opportunity comes.

Graduate Division

War duties in home communities, increased cost of living, scarcity of rubber and gasoline, and other factors have resulted in greatly decreasing the enrollment in our graduate department. Should the war continue much longer, this department might have to be postponed "for the duration".

Part-Time and Summer Division

What was said about the Graduate Division can be repeated here. This is vividly brought home to us by the fact that in the present summer term we have an enrollment of 182, about a third of what it once was. The abandonment of our accelerated program, as suggested in the first part of this report, would increase the difficulty of keeping our summer term alive.

Students' Organizations

The year has seen a decline and fall of several of our student clubs. Rather than discontinue clubs which ceased to be active, the Student Government Association decided to withhold action till the return of more normal times. The accelerated program has added to the problems confronting clubs. Many of them are restricted to Juniors, Seniors, etc. It is now difficult to know just when a student ceases to be a Sophomore and becomes a Junior. In an attempt to aid in this matter, the Student Government Association has ruled that so far as clubs are concerned, the Summer Term shall be classed as a semester. Students having completed two "semesters" are Sophomores, and so on. The chaotic condition is shown by the fact that Kappa Delta Pi had three presidents in the past academic year. Not all problems confronting the clubs are due to acceleration. War with its unrest and other problems come in for their share.

Because of the inclination of the student body to elect men as members of the governing board of the Student Government Association, because of our two semesters of supervised teaching this year, and because of the induction of our men into armed service, there have been periods when we have not had a quorum of S.G.A. members on the campus. The group has not been composed of the same members for any two meetings of the entire year. This state of affairs is not conducive to the effieient handling of student matters. Note that practice teaching shares with armed service in bringing it about.

General

Plans have been made in the Music Department for two minors, one in choral music and the other in instrumental music. Details of the

plan were submitted last autumn. Inasmuch as it is necessary for our students to major in English, Social Studies, Mathematics, Language or Science, the two minors cannot be counted as a major. By choice of electives in the junior year, a student can take both music minors.

Because of the added teaching load in the Science Department entailed by my leaving, it would seem that 8 semester-hours of additional teaching help should be secured.

It is quite a coincidence that four major vacancies occur this year, Head of Social Studies, Head of Integration, Dean of Women, and Dean of Instruction.

It is with genuine regret that I terminate my sixteen years of service with you.

Charles W. Finley
Dean of Instruction

October 1, 1943

President Harry A. Sprague
State Teachers College
Montclair, New Jersey

My dear Dr. Sprague:

I submit herewith the report of the Office of the Registrar of the College for the academic year, 1942-1943. The accompanying tables constitute the main part of this report and set forth the facts concerning our enrollment statistics and the number and distribution of our graduates for the college year. This year has marked the development of the accelerated curriculum, approximately fifty-nine per-cent of our students having availed themselves of the courses offered in the summer session and during the two annual semesters to complete degree requirements at a date earlier than was previously possible. Because of this acceleration an unusual number of students were graduated in the one year with the degree of Bachelor of Arts, a total of two hundred and seventy-four. Three commencements were held; namely, January 15, May 20, and August 13, 1943.

A study of the enrollment statistics will reveal the fact there has been a noticeable decrease in the number of our students during the academic year. This is explained by two facts, the number graduated at mid-year and the number of our young men who entered the armed forces of the United States. The total number who withdrew for the latter reason from September 8, 1942 to August 31, 1943 is one hundred and thirty-nine or almost twenty per-cent of our enrollment September 8. While it is not properly a part of this report it has seemed to me an appropriate place to attach, as a matter for future reference, the ruling of our governing Board as to the credits allowd, academically, for the college work from which these students withdrew at the time of induction.

During this year the office personnel changed as follows; Miss Frances H. Moller, who had been appointed February 1, 1942, resigned to join the WAVES and left April 1, 1943. Miss Frances Van Etten succeeded her, taking up the duties in the office June 15, 1943.

Respectfully submitted

Charlotte G. Marshall
Registrar

I. The revised statute regarding college credit for seniors who enlist or are drafted reads as follows:

"Any pupil in any of the public schools or educational institutions who shall enlist or be drafted into the military or naval forces of the United States after having commenced the work of his senior year, and who has satisfactorily completed his work in the school or institution up to the time of his enlistment, shall be given credit for the work of the then present term without examination, and shall be entitled to and receive the diploma, certificate, degree, or other credentials or standings awarded to those pupils or students of the school or institution who shall satisfactorily complete the work for the term."

II. David T. Wilentz, Attorney General for the State of New Jersey interprets the above as follows:

"It seems to me that the work "term" as used in that statute necessarily means the school year, which under Section 18:14-76 begins on July 1st and ends on June 30th."

III. A statement from the State Department of Education relative to credit which may be received by juniors, sophomores, and freshmen who are drafted or enlist after January the 26th is as follows:

Students with junior, sophomore, or freshman classification who are inducted into service during the second semester will receive the following credits. If the induction takes place one month after January 26th, they will receive 4 semester-hours of credit. If the induction takes place two months after January 26th, they will receive 8 semester-hours of credit. If the induction takes place three or more months after January 26th, they will receive 16 semester-hours of credit.

The above credits are granted provided the college work up to the time of induction is satisfactory and all college bills are paid. Tuition will be refunded on a pro rata basis.

ANALYSIS OF ENROLLMENT
STATE TEACHERS COLLEGE AT Montclair
DATE October 15, 1942

	Year in College				Totals	Sex	
	First	Second	Third	Fourth		M	F
For Secondary Teachers							
Business	27	30	24	16	97	29	68
English	44	39	37	40	160	15	145
Foreign Languages	29	24	22	22	97	20	77
Mathematics	39	19	25	18	101	30	71
Science	25	18	19	17	79	43	36
Social Studies	49	41	39	33	162	53	109
TOTALS	213	171	166	146	696	190	506

Distribution of Enrollment by Counties
for Montclair State Teachers College

as of October 15, 1942

County	Men	Women	Total
Atlantic	4	3	7
Bergen	25	55	80
Burlington	1	3	4
Camden	1	5	6
Cape May	1	2	3
Cumberland	-	7	7
Essex	86	197	283
Gloucester	-	2	2
Hudson	17	53	70
Hunterdon	-	1	1
Mercer	2	1	3
Middlesex	3	6	9
Monmouth	4	15	19
Morris	3	19	22
Ocean	1	6	7
Passaic	26	72	98
Salem	1	1	2
Somerset	4	5	9
Sussex	-	6	6
Union	11	43	54
Warren	-	3	3
Out of State	-	1	1
TOTALS	190	506	696

ANALYSIS OF ENROLLMENT
STATE TEACHERS COLLEGE AT Montclair
DATE February 1, 1943

	Year in College					Totals	Sex	
	Jan. Fresh.	First	Second	Third	Fourth		M	F
For Secondary Teachers								
Business	5	23	29	7	18	82	21	61
English	10	38	41	13	40	142	13	129
Languages	3	22	23	3	21	72	15	57
Mathematics	9	34	17	4	21	84	28	56
Science	6	21	19	9	11	66	34	32
Social Studies	8	44	43	9	31	135	40	95
TOTALS	41	182	172	45	142	581	151	430

DISTRIBUTION OF GRADUATES

STATE TEACHERS COLLEGE AT Montclair

For year ending January 15, 1943

	Not previously Eligible for Certificate		Previously Eligible for Certificate		Total	
	Men	Women	Men	Women	Men	Women
For Secondary Teachers						
Business	9	8			9	8
English	1	24			1	24
Foreign Languages	3	18			3	18
Mathematics	3	12			3	12
Science	8	7			8	7
Social Studies	10	22			10	22
TOTALS	34	91	-	-	34	91

DISTRIBUTION OF GRADUATES

STATE TEACHERS COLLEGE AT Montclair

for year ending May 20, 1943

	Not previously Eligible for Certificate				Previously Eligible for Certificate		Total B.A.		Total M.A.	
	Men		Women		Men	Women	M	W	M	W
For Secondary Teachers	B.A.	M.A.	B.A.	M.A.	M.A.	M.A.				
Business	2	-	-	-	-	-	2	-	-	-
English	3	-	13	1	1	5	3	13	1	6
Foreign Languages	1	-	1	-	-	3	1	1	-	3
Mathematics	3	1	1	-	-	-	3	1	1	-
Science	1	-	3	-	1	2	1	3	1	2
Social Studies	3	-	2	1	2	3	3	2	2	4
TOTALS (B.A.)	13		20				13	20		
Administration & Super.		-		-	7	-			7	-
Personnel & Guidance		-		-	2	3			2	3
TOTALS (M.A.)		1		2	13	16			14	18

DISTRIBUTION OF GRADUATES

STATE TEACHERS COLLEGE AT Montclair

For year ending August 13, 1943

	Not previously Eligible for Certificate		Previously Eligible for Certificate		Total	
	Men	Women	Men	Women	Men	Women
For Secondary Teachers						
Business	5	11			5	11
English	1	25			1	25
Foreign Languages	6	13			6	13
Mathematics	7	11			7	11
Science	3	5			3	5
Social Studies	9	20			9	20
TOTALS	31	85	-	-	31	85

ANNUAL REPORT OF THE SUMMER, PART-TIME, AND EXTENSION DIVISIONS-September 15, 1943

On the home front, the period from July 1, 1942 to July 1, 1943 was probably the most difficult that we shall experience during the war. It was the period when the most arduous efforts were being made to prepare the largest number of young men in the shortest possible time to enter the armed forces, as well as being the period when both agriculture and industry were endeavoring to produce more than ever before in the history of the United States, so that we might change from the defensive to the offensive.

In this college, and in these divisions of this college, every possible effort was put forth to be of help to present and to former students. A great many transcripts of work taken in previous years were prepared at the request of former students entering the army, navy, and marine corps and sent to them without the usual service charge. Courses were offered that would give specific training for particular forms of service, such as avigation and navigation, meteorology, medical laboratory techniques, radio, and similar fields, so that students once in the service could be placed quickly when they could be most useful. Other courses were offered that would assist the high school teacher to prepare to be similarly helpful to their high school students graduating into war service.

In thus concentrating on the needs of the moment, it was not always possible to offer all the degree courses that we would have liked to offer. Some students have been unable to make the progress toward obtaining a degree that they would have made in peace time. There has been, however, a sincere attempt made to maintain a program of continuous offerings insofar as it was possible to do with the faculty time available. During the fall and spring semesters, many courses on the graduate and senior level have been given, and a few on the lower levels. Last summer, with so large a part of the time of the faculty devoted to the accelerated undergraduate student of the regular college classes, there was not as much time left as usual for graduate courses. The graduate students felt this and complained to me about it. This condition will continue, naturally, so long as we have the accelerated program in force during the summer.

On the other hand, because of this very situation, it was possible during the summer of 1942 to offer for the first time in years a full program of undergraduate studeis to the students matriculated for the A.B. degree through these divisions of the college. Since we have had a graduate school, the larger part of our A.M. degree candidates have taken all of their courses through the Part-Time and Summer Divisions of the college. For this reason, the larger part of our summer offerings have for years been directed toward the candidate for the A.M. degree and the graduate student seeking the secondary certificate. With the accelerated program in effect in the summer of 1942, the A.B. candidates could find courses being offered that they had long been awaiting in order to complete work for the degree. It is a pity that more of them did not take advantage of this opportunity.

There was one drawback to this apparently advantageous situation, however. Since the first part of a four-semester-hours credit course was given to the accelerated students before the opening of the summer session, the summer session student had perforce to take the second part of the course. That would not have mattered particularly if, in the summer of 1943, the student could find the first part of the course being given during the second six weeks; but, naturally, it would again be the second part of the course that would be open to him. This will be true in succeeding summers also, thus making it difficult for the A.B. candidate to take the first part of any course.

If there were a larger number of the A.B. candidates, we could serve their needs by offering more of the undergraduate courses, or at least the first half of them, during the fall and spring semesters. There are however, only 93 of them, with their majors scattered, which is a small number compared with the 369 students matriculated for the A.M. degree. It is evident, therefore, that we must continue to give our first attention to the graduate students.

With the advent of the new Dean of Instruction, it seems to me an opportune time to attempt to discover how many of the 93 candidates for the A.B. degree are genuinely eager to complete the work for it. Then a supreme effort could be made to assist those, while the cards of the others could be placed in the inactive file. We have had only a very few new candidates for the A.B. degree come to us since the other teachers colleges of New Jersey began giving degrees, for the reason that most of these students were already normal school graduates and preferred to complete their work in the field of elementary education. The few who have come to us lately are usually liberal arts college students who did not complete their work and who now desire to enter the high school teaching profession. Frequently they can do part of their work as special students during the day and thus find it easier to obtain all the courses necessary for the degree. There are undoubtedly many students among the earlier matriculants who have little or no interest in obtaining the A.B. degree in secondary education, and these, I feel, might better be placed in the inactive files.

There has been, naturally, a drop in the total attendance from that of a year ago. Most of our students are teachers-in-service, and the calls upon their time during the past year for various forms of war service have been legion. Many of them spent the summer vacation working in war plants, and their evenings during the academic year in home defense, Red Cross, ration board, and similar activities. Their desire to be of help to their students soon to graduate into war service, however, brought them in large numbers to the college Saturday after Saturday during the year to take the courses being offered in aviation, radio, and the like. Thus the figures given below indicate that these divisions of the college have been of help to many of the teachers and prospective teachers of this area during the past year.

Enrollment Data

	1942 Summer Session	1942 Fall Semester	1943 Spring Semester	Year's TOTAL
Undergraduates	80	74	85	239
Graduates	168	241	284	693
Total	248	315	369	932
Men	70	146	166	382
Women	178	169	203	550
Total	248	315	369	932

It would appear from the above figures that a large majority of the matriculated candidates for the A.B. had been attending. For example, for the fall semester, 74 of the 93 would have been a goodly number. The fact is, however, that only 36 of this 74 were matriculated at Montclair. The others were either matriculated at other colleges or individuals not interested in taking work for a degree. And of the 36, several were students of our regular college having permission to take additional work.

Advertisements have been placed from time to time in the New Jersey Educational Review and in the newspapers of the area served by the college, to draw attention to the offerings of the summer, part-time, and extension divisions. It seemed to me that the best response was to an advertisement in the papers. The usual summer session bulletins and the announcements of the fall and spring semesters have been widely distributed. The use of the brief announcement for the fall and spring, rather than the

complete bulletin, has been most satisfactory. Students like the concise information as to the meeting time of the courses and the leaflet fits easily into pocket or purse. Only a few students, unfamiliar with our curricula, have felt it necessary to ask for course descriptions in addition to the announcement. In the summer session, when we have so many students coming to us from other colleges to begin work for the secondary certificate or simply for credits to take back to their own colleges in the fall, there still remains need for the bulletin containing the course descriptions.

The situation regarding off-campus courses remains the same as for some time past. In keeping with the policy adopted to give such courses only when self-sustaining, we have refrained from the casual placement of courses off-campus. From time to time, a request comes to us for a particular course with a guarentee of a sufficient number of prospective students to enable the course to be given without financial loss to the college. A course in Multi-Sensory Aids was thus given during the spring semester in Sussex County to the satisfaction alike of the school authorities there, the students who attended, and to the administration of the college. Letters were mailed during the spring to the Supervising Principals of many communities in this area, offering courses for the fall semester of 1943. To date, only one response was favorable, but possibly others will desire courses for the spring semester of 1944.

On the whole, the work of these Divisions of the college has been less hampered by the war than had been anticipated. Once the students can again commute to the college in their cars, I am sure that many more of our candidates for the Master's degree will return to complete the work for the degree. And when the war ends, I look for a greatly increased enrollment in the graduate courses.

I hope that we can begin to look forward to the victory and to the larger world outlook that must necessarily be ours in the post-war years. I hope that we can continue to emphasize the offering of courses that will contribute toward such an outlook, not only in the social studies and geography, but also in the languages. I hope that, in addition to our present offerings in Spanish, we can then give more advanced work through these divisions, and perhaps, ultimately, offer Portuguese also.

Respectfully submitted,

Elizabeth S. Favor

Elizabeth S. Favor, Registrar
Summer, Part-Time & Extension Divisions

REPORT
COLLEGE HIGH SCHOOL
1942 - 1943

I. Trends and Developments.

1. The Victory Corps

The high school joined the Victory Corps and was engaged in active home war work during the entire year. About an equal number of students joined the four main divisions of the Corps.

We scheduled several assembly programs which were devoted to war work and to a better understanding of war and peace problems.

Many of our students were engaged in service for the Red Cross and in specific service for Civilian Home Defense.

In the Spring our students joined the farm service work program and several continued in this service during the summer.

The members of the present senior class (about twenty-six in number) were actively engaged in war work of various and diversified types during the entire summer earning over three thousand dollars in this service.

I. Trends and Developments (continued)

2. Curricular Adaptations to War Purposes.

A. The Western Culture Curriculum given to students of the ninth grade by Dr. Fulcomer and Dr. Snyder.

B. The program of the interpretation of the intricacies of our present situation- propaganda- radio- news-paper- current discussions and speeches given in the tenth grade by Professor Conrad.

C. The program by Professor Nickerson directed toward a better understanding of our American neighbors;- this developed in the seventh grade English classes.

D. Adaptations and adjustments in Science and Mathematics to war needs.

E. Formal drill and commando exercises in physical education.

The above are but a few of the outstanding examples given in every department. These are not mentioned in detail since the department heads will report this material in detail.

3. Attitude of the School.

A marked development in school citizenship and an improved attitude toward civic and national responsibilities. An increased appreciation of the fundamental values of American life. A better understanding of the American home, of food, of simple amusements and friendships. Our school became a large family and was more closely consolidated into an articulate, homogeneous unit than we have experienced in the last eight years.

I. Trends and Developments (continued)

4. The Parent-Teacher Association.

This organization had its best years in 1942-1943. The organization joined in all your cooperative efforts with real zeal and true patriotic fervor. An exchange for clothing and sports articles desired by the children was instituted. This will be extended during the coming year.

5. A better Utilization of our Immediate Facilities.

Definite attention was given to the conservation of material and human resources. We got along with what we had. We did our best to understand and to enjoy our fine environment, our campus in fall, winter and spring, and our isolated, peaceful and beautiful location overlooking New York, and all the tangled meanings of this critical time.

II. Statistical Data.

1942-43 Enrollment:

Grade	7th	8th	9th	10th	11th	12th	Total
Boys	10	14	14	13	14	11	76
Girls	13	12	16	16	12	19	88
Total	23	26	30	29	26	30	164

Number of teachers devoting part time to C.H.S.		
	Men	23
	Women	14
	Total	37

Number of graduates, May, 1943 30

III. Staff and Staff changes.

1. The staff has responded to every need occasioned by our present dislocations. Our professors have not permitted home problems or any insecurities caused by the war to enter into the work of the high school. Knowing the stresses under which some of the staff were working during the past year, it is amazing how well this was kept from our high school students. The high school was given a real professional year of service in the school year of 1942-1943.

IV. Studies Undertaken.

1. South American, or Western Culture curriculum continued in ninth grade classes.
2. In mathematics and science several studies were developed. These will be reported in the departments where they were developed.
3. A thorough survey of mastery of fundamentals in English for the entire high school.
4. A survey of pupil interests in reading by the library.
5. Uses of visual aids as applied to the library.

V. Recommendations:

1. We still need a more closely knit program of parent teacher relationships. Our teachers, not our parents, are at fault.

2. We need better facilities for work in dramatics.

3. We need a more unified approach, a better understanding of the work of the various departments and a unification of our separate endeavors. This should be aided by a few faculty meetings given at the high school this coming year.

V. Recommendations (continued)

4. We have at our college a group of experienced and expert teachers as heads of our various departments. We should now capitalize on their rich experience for the future. We may build a college auditorium, a science and mathematics building, and a building for physical education, but we should now begin to draw up plans for a new demonstration school building. In the present war period, we should have ready blue prints and equipment needs for instant presentation when the right time and opportunity arrive.

Arthur M. Seybold

Arthur M. Seybold,
Director, College High School.

Personnel Office Report

1942 - 1943

A summary of major work of Personnel Office:

1. Counselling and Conferences

Types and comments

Military service enlistment and examinations. This activity has consisted of explaining requirements, affording assistance in filling out registration blanks, writing certificates and recommendations, and furnishing records of extra-curricular activities. The men are accepting the prospective service as a matter of course.

Student employment. Every student who needed or wanted to work secured part-time employment. Our problem was advising students to spend not more than a reasonable amount of time in outside employment.

National Youth Administration employment. It has been difficult to find students who qualified for this aid. Approximately seventy-two percent of the allotment was used.

Scholastic and personal difficulties. It seems that much more time has been devoted to this activity, and it is my impression that the excessive difficulties have been due partly to the strain of the accelerated program.

Service men on furlough or leave. Six to ten former students have returned to visit each week. These visits, although time consuming, have been enjoyable and interesting, and have resulted in building good will toward the college and its faculty.

2. College Studies and Service

Draft status of male students. During the year twenty-seven seniors, thirty juniors, thirty sophomores, and thirty freshmen, or a total of 117 students, entered the military service.

Rank and Number of Montclair Men and Women in Military Service:

Rank	Men	Women
Major	1	
Captain	4	1
1st Lieutenant	7	1
2nd Lieutenant	61	2
Sergeant	10	
Corporal	18	1
Private 1st Class	24	
Aviation Cadet	39	
Assistant Adjutant	1	
Ensign	21	2
Lieutenant (j.g.)	2	1
C. P. O.	4	
Ch. Lp.	1	
A. S.		4
Auxiliary		2
Seaman		3
	198	
Classification Unknown	195	
Total	393	22

College Status of Men and Women Entering Military Service:

	Men	Women	
Graduates	235	21	
Undergraduates	144	1	
Faculty	5		
Withdrawn prior to entry into service	9		
	393	22	415

Alumni Bulletin. A printed service list containing names and addresses was mailed to each enlisted person, their parents or wives, and the active members of the Alumni Association.

Photostat Service: Copies of permanent records have been furnished upon request to all alumni and undergraduates entering the military service and to Army, Navy, and F.B.I. offices. This has been done free of any charges. Fewer transcripts have been needed by the Integration Department.

Addressograph Service: The addressograph plate file now includes the elementary principals of the State, and an order which will include the private and parochial school principals list and corrections of secondary school principals list has been made. The Alumni plate

file is now classified by year of graduation and the plates are being identified by tabs to indicate teachers, those teaching their major subject, active membership, and interest.

Occupation and nationality of entering freshmen:

Nationality of Parents	Number	Percent
Total students	160	100
Both parents American born	91	56.9
One parent American born - one foreign born	21	13.1
Both parents foreign born in same country	38	23.8
Both parents foreign born in different countries	10	6.2

Occupation of Parents	Number	Percent
Total students	160	100
Business	64	40
Profession	27	16.8
Tradesmen, skilled mechanics, foremen, etc.	59	36.8
Retired	2	1.3
No occupation specified	4	2.5
Deceased and not included above	3	1.9
Disabled	1	.7

3. Tests, Scoring, and Interpretation

Entrance examinations: These examinations were administered in September (one), January (one), and May (two).

Sophomore Testing Program: Tests in English, American History, General Culture were administered to the members of the sophomore class. The ratings as I interpreted them, are slightly lower than those made by the Class of 1941 and former classes.

United States A-12 and V-12 Examination. Thirty-seven Montclair men took this test. The scores of a few of these men were reported to the college and were favorable. We have no knowledge of any man failing.

National Teacher Examinations. These examinations were given for the second time in the college. Seventy-two of the regular and accelerated seniors took these tests and their record is summarized as follows:

Number of Students Equaling or Excelling
Designated Norms on Particular Tests

	Test Numbers											
	1	2	3	4	5	6	7	8	9	10	11	12
Exceptional 80-100%ile	1	7	12	3	1	8	3	1	11	4	1	1
Superior 70-79%ile	17	19	22	14	10	18	14	11	11	20	11	16
Average for N.T.E. Candidates 60-69%ile	25	31	25	24	34	28	19	24	30	19	24	28
Av. for Unselected Individuals 50-59%ile	20	14	10	26	19	16	25	26	15	26	26	25
Below	9	1	3	6	8	2	11	10	5	4	10	2

Test #1 Reasoning	Test #7 Science
" #2 Encligh Composition	" #8 Fine Arts
" #3 English Expression	" #9 Mathematics
" #4 Current Social Problems	" #10 Professional Information
" #5 Social Studies	" #11 Contemporary Affairs
" #6 Literature	" #12 Common Examination Total Score

Number of Students Equaling or Excelling Designated
Norms on Specified Number of Tests

	Number of Tests													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Exceptional	14	6	5	1	1	1	1							
Superior	9	11	10	8	3	5	5	2	5	1	3		1	
Av.for NTE Candidates	2	3	2	3	7	5	4	1	5	3	5	11	13	6
Av.Unselected Individual					2			1	1	6	3	7	19	33
Below	15	2	5	4		1			2					

Rating Made by Seniors (1943) in Major and Minor Subjects

	Seniors 1943				Seniors 1942			
	Majors		Minors		Majors		Minors	
	#	%	#	%	#	%	#	%
Exceptional	11	15	1	2	24	21	5	6
Superior	31	43	6	12	57	49	20	24
Av.NTE Candts	16	22	25	51	32	27	41	50
" Unsel.Inds.	10	14	13	27	4	3	16	20
Below	4	6	4	8	0		0	
Did not take	0		23		0		0	
Total	72		72		117		117	

I have included in this last table corresponding data for the seniors taking the test in 1942. The scores of these two classes in relation to the norms make it appear that the Class of 1942 was much better than the Class of 1943.

4. Student Financial Aid

Type	Number of Students	Value	Total
Scholarships			
State	79	$9,160.00	
Russ	2	150.00	
Howe	2	257.00	$9,567.00
Loans			
State	35	2,809.50	
Chapin	2	212.50	3,022.00
N. Y. A.	61		2,432.87
Student Fellowships and " Assistants	2	1,025.00	
Laboratory Assistants	14	975.00	
Waitresses	73	4,946.00	
Office and Miscellaneous	30	611.48	7,557.68
Total	201		22,579.55

5. State Scholarship Students

	Classes Entering			
	1939	1940	1941-42	1942-43
Number Initial Appointees	16	18	23	24
Withdrawals	0	0	0	0
Entering U. S. Service	1	4	6	3
Dropped (poor record)	0	0	0	0
On Probation	0	0	1	1
Replacements	0	1	0	
Replacements to be made			6	5
Graduating 1943	16	16	0	0
Original Appointees	13	13	17	19

6. Alumni Activities

Meetings:

Executive Committee Meetings - 9

Alumni-Senior Christmas Party

February 12th Home Coming

May Business Meeting

Activities

Christmas boxes to all enlisted alumni

Two editions of the "Alumnac"

Office

Alumni in military service

Card file address, rank and location of all known alumni in service

Correspondence and file

Register for visitors

Photographs of visitors

General

Corrections of file

Collecting information for file of outstanding alumni

Respectfully submitted,

Claude E. Jackson
Director of Personnel

ANNUAL REPORT OF THE LIBRARIAN FOR THE YEAR 1942/1943

I. TRENDS AND DEVELOPMENTS

Library Instruction

The policy decided upon at the end of 1941/1942 - namely the presentation by the Library Staff of a series of lessons to Seniors in their departmental methods classes - was carried out with gratifying success. Each class was given at least one lesson, bringing to the students' attention the facilities which the Library offers to assist them in their practice teaching, and the particular tools which should be included in their personal or High School libraries. This selection was varied to meet the special needs of each department of instruction. In several classes a talk was given by the Director of the Audio-Visual and Teaching Aids Service, outlining its facilities for practice-teaching and for use after graduation. The English majors were also given a talk by the Librarian of the College High School, discussing the use of the bulletin board as a teaching aid, and developing the artistic and psychological principles underlying its preparation.

This service will be expanded to a considerable degree during the year 1943/1944. The full series of three talks has already been scheduled for four methods classes, and several others are still to be arranged.

The work with Freshmen as a group is confined to an introductory talk by the Librarian at the beginning of the year, but all members of the Library Staff take especial pains to assist Freshmen to solve their individual problems.

High School Library

The report of the High School Librarian is appended to this report. The increase of nearly 17% in circulation can probably be attributed to the large number of new and attractive books which were added to the High School Library during the year, and to the withdrawal from the shelves of out-of-date and worn-out volumes.

Audio-Visual and Teaching Aids Service

The report of the Director of this Service is appended to this report. The program of student apprenticeship has made the work of this department of vital interest to participants, and has in part compensated for the loss of W.P.A. help.

Bibliographies compiled

The Librarians prepared the following lists during the year:

AERONAUTICS: A list of books in the Libraries of the ... College. Comp. by Margaret G. Cook. March, 1943. 11p.
AVIATION BOOKS FOR THE HIGH SCHOOL LIBRARY: A list of books in the Libraries of the ... College. Comp. by Margaret G. Cook. March, 1943, 3p.
WAR-TIME GUIDANCE: A bibliography of materials available in the College Library, July, 1943. Compiled by Anne Banks Cridlebaugh. July, 1943.

The Librarian also edited SCIENCE: AUDIO-VISUAL AND TEACHING AIDS. (1943) Comp. by George Flimlin. 53p.

The services of the departments of the Library remain as they were outlined in the report for the year 1941/1942.

II. STAFF AND STAFF CHANGES

The Library Staff is as follows:

Librarian
    Margaret G. Cook
Assistant Librarian
    Anne Banks Cridlebaugh
Head of Loan Desk
    Florence W. Holmes
Director of Audio-Visual and Teaching Aids Service
    Lili Heimers
Librarian of College High School
    Mrs. Mollie C. Winchester
Assistant
    Emma Fantone

A year ago, the discontinuance of the W.P.A. left the College Library without the clerical help for which we had relied so heavily upon it. Miss Margaret Stevenson, who had been with us under the W.P.A. for about seven years, remained until the end of May as a part-time assistant. Miss Emma Fantone began work with us on a part-time basis in the Fall, and did not come to us full-time until the beginning of the second semester. In addition to the typing and clerical work connected with the ordering, receipt, and cataloging of books, Miss Fantone has charge of scheduling the Visual Equipment for the use of the Faculty and Student organizations, arranges for hiring student operators for the machines, and orders films for loan or for rental. In addition she is frequently called upon by other departments for emergency aid, thus reducing her time in the Library.

III. STUDENT ASSISTANTS

While the N.Y.A. supplied us with some student assistance during the year, it was considerably less than in the previous year, and correspondingly less adequate for the routine processes of keeping files and shelves in order. The Library is open 58 hours a week. In addition to the need for one student at the Loan Desk during most of this time, we need additional hours of specialized services: mending and binding, clerical work, preparation of new books, and typing; in other words, a total of at least 70 student hours per week.

SUMMER SESSION, 1942 - Paid from Summer Session Funds

Gerald Burman	12 hours per week	$ 24.00
Mary Bleecker	6 " " "	12.00
John Keeler	6 " " "	12.00
Florence McCabe	6 " " "	12.00
Jack Malovany	6 " " "	12.00
Sylvia Merlin	6 " " "	12.00
Antoinette Micele	6 " " "	12.00
Jennie Polizzi	6 " " "	12.00
	54 " " "	108.00

FALL SESSION - N.Y.A.

Robert De Nyse	7 hours per week
Lucy Fabrizio	7 " " "
Sylvia Merlin	7 " " "
Antoinette Miceli	7 " " "
Jennie Polizzi	7 " " "
Marie Rienzo	7 " " "
	42 hours per week

SPRING TERM - N.Y.A.

Lucy Fabrizio	7 hours per week
Elizabeth Hopper	7 " " "
Avice Lusk	7 " " "
Melonia Krussewska	7 " " "
Marie Rienzo	7 " " "
	35 hours per week

IV. STATISTICAL STUDIES

A. LIBRARY EXPENDITURES

Books	$ 3343.50
Periodicals	547.04
Binding	391.42
Supplies	430.13
TOTAL	$ 4712.09

This exceeds by $777.61 the amount spent for the Library from the College budget during 1941/1942. (In 1941/42 the Carnegie grant provided $573.78 for books)

B. ACCESSIONS AND WITHDRAWALS

	Main Collection	Textbook Exhibit	Total Main	H.S.	TOTAL
In Lib. July 1, 1942	39,669	2,786	42,455	3,422	45,877
Additions, 1942/43	1,888	296	2,184	272	2,456
Withdrawals, 1942/43	310	64	374	163	537
Net gain	1,578	232	1,810	109	1,919
IN LIBRARY, JULY 1, 1943	41,247	3,018	44,265	3,531	47,796

CATALOGED PAMPHLETS IN GRAND TOTAL 6,117 or 12.7% of the total
DUPLICATE COPIES IN GRAND TOTAL 12,642 or 26.4% of the total

C. CIRCULATION TOTALS

Monthly totals of books loaned

	non-reserved books	reserved books	total
July, 1942	3735	1294	5029
August, 1942	1606	472	2078
September, 1942	3136	735	3871
October, 1942	4068	863	4931
November, 1942	3958	858	4816

	non-reserved books	reserved books	total
December, 1942	3450	841	4291
January, 1943	2642	812	3454
February, 1943	2992	419	3411
March, 1943	3900	533	4433
April, 1943	4143	703	4846
May, 1943	2207	591	2798
June, 1943	1453	399	1852
TOTAL MAIN LIBRARY	37290	8520	45810
TOTAL COLLEGE HIGH SCHOOL			8337
GRAND TOTAL			54147

D. PER CAPITAL CIRCULATION

As shown in previous reports, the average annual per capita loans in 55 colleges and universities was 12. According to the following table, at Montclair it averages 64.34.

MONTH	NO. OF FULL-TIME STUDENTS	NO. OF STAFF MEMBERS	WEIGHTED NO. OF PART-TIME STUDENTS	TOTAL BORROWERS
July, 1942	424	46	62	532
Aug.	424	46	62	532
Sept.	696	64	79	839
Oct.	696	64	79	839
Nov.	696	64	79	839
Dec.	696	64	79	839
Jan. 1943	696	64	79	839
Feb.	581	63	92	736
Mar.	581	63	92	736
Apr.	581	63	92	736
May	581	63	92	736
June	296	31	12	339

The average number of borrowers is	712
Total circulation	45,810
Average per capita circulation	64.34

Figures from the Office of the Part-Time division show that students in the Division take about one-fourth the number of course hours taken by the full-time Students. The enrollment figures are weighted accordingly, students in the Part-Time Division being counted as $\frac{1}{4}$ borrower.

V. RECOMMENDATIONS

A. RECOMMENDATIONS FOR EXPANSION AND EQUIPMENT

The recent alterations in the College building have now made all previous suggestions for expanding the Library impossible of achievement. However, one possible plan of action remains.

If a portion of Room 4, directly adjoining the Library, were partitioned off as an office and catalog room for the Librarian, with the doorway between the rooms reopened, the bookshelves now dividing the Visual Aids department from the present cataloging department could be moved somewhat nearer to the Loan Desk, more cabinets to contain Visual materials could be accomodated, and the intervening space now occupied by tables could be filled with additional bookstacks. These stacks would accomodate the Music books and the Textbook Exhibit, as well as the Carnegie Art set. This would give some room for growth in the stacks in the main reading room.

New card files recently purchased will accomodate additions to the catalog and other files. However, the Clipping and Pamphlet files are now too full. While the weeding of these files goes on continually, the addition of new subjects to the curriculum makes growth inevitable. The Visual Aids Collection has grown to such an extent that its cabinets are also too full. The doors have been removed so that the shelves can be filled to their utmost capacity. Two additional cabinets, similar to those now in the Department should be added.

The collection of recordings of speech and music remains in the Librarian's Office for want of a cabinet in which to house it. The construction of such a cabinet has been approved, but materials seem to be unavailable.

The High-School Librarian has for several years requested a glass-topped exhibit case, table type. With the cooperation which she offers to all departments of the school, such an expenditure might well be considered as a service to the school as a whole.

VI. SUMMARY

The College Library has served a slightly reduced student body, which has borrowed from it 12,000 less books during the year than they borrowed the year before. This has meant a reduction of only 12 books per capita, however. The Circulation still exceeds one loan per volume of the total stock. The College High School shows a circulation of more than 2 loans per volume.

To offset this reduction, we can point to increased use of the Library for special purposes - talks by the Librarians, booklists compiled, and increased use of the reference facilities of the main library and the Visual Aids Service. Though the statistics of additions show a decrease in books added, that is caused by the fact that books are not counted as added until they have been cataloged. The expenditures for books and periodicals exceeded those of the previous year by almost $800.00. If more clerical help becomes available, the lag between receipt and cataloging can be decreased. This lag was in earlier years taken up by emergency appointments during the Summer. These have not been resorted to during recent years, as the present clerical assistant is not able to keep up with the work prepared for her, so that additional professional work would increase the congestion, rather than improve the situation.

Our two greatest needs, therefore, are increases in space and in clerical and student personnel.

Respectfully submitted,

Margaret G. Cook

Margaret G. Cook
Librarian

REPORT OF THE LIBRARIAN OF COLLEGE HIGH SCHOOL
1942/1943

TRENDS AND DEVELOPMENTS

The projectile pace of war-time demands in the fields of science - aviation, chemistry, physics, radio, etc. - has crowded our shelves with up-to-the-minute material, for classroom and for free reading. Housecleaning in the fiction section opened space - not for stories of romance - but for vocational tales, war-nursing, flight hostesses. For boys, real life - airmen's skill and valor.

ACCESSIONS

The College Librarian has again granted a generous understanding of our needs and filled many special orders. Miss Holmes has watched the magazine situation and kept us aware of pertinent publication, vital for the students' use. Dr. Heimers has given us valuable duplicates from her collection. All such aids are important.

ENGLISH DEPARTMENT AND THE LIBRARY

The Ninth Grade again donated about fifty dollars for a dual subscription to the Junior Guild Books. This assures at least two well-chosen and outstanding juvenile books each month. This gift reached a zenith of usefulness when Dr. Fulcomer's summer workshop group studied in College High School Library.

Professor Nickerson's 7th Grade class again used the Library as laboratory. For the creative project each student wrote a story of South America. Under the Librarian this was illustrated in oil and water color and finally the finished book bound in hard covers. Many college students came to observe this work, so aims, objectives and results had the challenge of demonstration lessons.

COLLEGE CATALOGS

The special room for college catalogs grows in worth. However, since space is so limited we have devised a plan of reserving only those which are most likely to be required. Now, when a student or parent, wants some obscure, or far away western college, we send a postal asking that the bulletin be sent directly to the home. Over thirty requests have been filled in this way; the parents satisfied; our shelves clear of unique, and for us, static material.

RECOMMENDATIONS

I suggest an interchange of regular trained library-assistants at intervals. This would make for a deeper understanding of common problems in College and in the High School. The refreshing influence of a more reserved and poised - yet friendly and sympathetic - personality would be beneficial to the High School group. On the other hand, the College experience, working with the new and ever-incoming stream of reference material would stimulate the high-school Librarian.

Again, I suggest the purchase of a small museum floor-case. This is a valuable teaching device. The display of class projects, minerals, insects, radio parts, South American model, etc., stimulate groups beyond the class-unit. During the summer-tenancy of the Workshop group we had several expertly prepared exhibits in which the adult group expressed much professional interest. In coming seasons, an exhibition-case would permit expansion of this phase of the course.

EXTRA-LIBRARY ACTIVITIES

The Librarian continues as custodian of class-funds for the school, advising on all expenditures, stimulating projects that may enlarge class treasuries, banking all money.

The Senior Class of 1943 established a fund which, when adequate, will become a scholarship fund to aid needy students of College High School. The Class elected the Librarian as one of the Trustees of the Fund.

As Advisor of the 7th Grade, many socializing experiments were tried:

1. The 7th Grade students painted calenders at Christmas and sold them. The proceeds - twenty-five dollars (plus a contribution of $5.00 from Prof. Hatch) - were sent to the Greek Relief as our Christmas gift to the children of Greece.

2. This class enjoyed collecting books from friends and sent over 300 well-chosen books to Fort Monmouth.

3. The girls of 7th Grade knit in study-hours a large afghan for the Red Cross.

4. The boys organized and set-up a splendid exhibit of model planes, pictures, and autographs of famous airmen. Many valuable items were shown.

5. At Christmas the 7th Grade wrote a Christmas play - "The Living Tree." For this they designed all costumes and scenery.

6. The most outstanding project done by this class, under the Librarian, was the dedication of an oak-tree in honor of Professor Hatch. The pageant of all nations, ancient and modern, written by the students, and the costumes, and the phrasing of the dedication, and finally the presentation of the tree to the school, was an enriching social experience for this beginning class. In following years the class plans to earn money for a bronze marker, to be mounted on a boulder-seat at the base of the tree, to replace the inartistic metal sign now used.

The Librarian still teachers 7th Grade art, also assisting individual students in various art projects for other classes. During 1942-43 the Librarian worked with Professor Hatch, teaching the cultural phase of social studies - Egypt, Greece, Rome, one day each week. The students made interesting models of the Parthenon, Pantheon and other architectural monuments of the various periods. Also they made a series of lantern-slides to illustrate talks each student prepared as a term exercise.

The High School Librarian gave three talks in Jersey City on "Use of the Library" - one to the faculty, two demonstration lessons before large high-school classes.

STATISTICAL DATA

Circulation according to classes:

000	61
100	4
200	3
300	801
400	53
500	1324
600	371
700	197
800	1051
900	1426
910	867
B & 920	406
Fic.	1602
Pams.	171
Total	8337

Total 1942/1943	8337
Total 1941/1942	7128
Increase 1943	1209

No. of volumes in Library, July 1, 1943	3531
Magazines	102
College catalogs	181
Exhibits	14
Library lessons	9
Book talks	4
Lists made	2

Respectfully submitted,

M. C. Winchester, Librarian
College High School

ANNUAL REPORT OF THE VISUAL AIDS SERVICE OF THE COLLEGE LIBRARY
1942/1943

During this period the Audio-Visual and Teaching Aids Service of the College Library has added 311 cataloged units of teaching aids to its loan materials. The cataloging was done by 16 apprentices. They worked altogether 985 hours during the year. They learned to catalog, to check incoming materials, to file, to reenforce, to make portfolios, and to run visual aid machinery.

Many incoming pamphlets and books were cataloged by the director and added to the catalog as information. The pamphlets were sent to the reference librarian for the Vertical file; the books were added to the college library.

The following lists were prepared during the year:

MATHEMATICS
FLYING AND WEATHER
GENERAL SCIENCE

The following lists are in preparation:

RECREATION
GUIDANCE - PERSONAL AND VOCATIONAL
BUSINESS EDUCATION
CHEMISTRY, Vol. 2
GEOGRAPHY

7843 pamphlets and other free teaching aids from 121 different agencies were distributed to faculty members and their students, including graduate students.

Circulation: 939 units. This does not include the materials contributed to the Vertical Viles.

Help given: 805 individual students.

Among many other agencies the Teaching Aids Service has cooperated during the year with

The American Council on Education
China Aid Council
La Porte, Indiana, Board of Education
Institute of Life Insurance
Labelle County Community High School, Altamont, Kansas
Catholic Foreign Missions Publishing Company
National Association of Manufacturers
New Jersey Visual Education Association
Stromberg Carlson Telephone Manufacturing Company
Wright Aeronautics Corporation
The War Department, Office of Chief Signal Officer
The War Department, Adjutant General's Office.
The War Department, Headquarters, Army Air Forces
New York State Department of Education
The U.S. Office of Education
U.S. Airlines War Training Institute
U.S. Merchant Marine Cadet Corps
U.S. Naval Training Station, Newport, Rhode Island

At the suggestion of the Librarian, lectures were given in connection with methods courses in:

English Department
Integration Department
Music Department
Social Studies Department

The director of the Teaching Aids Service supervised the shipping of films for the Montclair Sound Film Library.

Requests

More filing space for units of teaching (closets) is urgently needed; likewise clerical help, as the students under the accelerated college program no longer have time to devote to apprenticeships.

Respectfully submitted,

Lili Heimers, Director
Teaching Aids Service

Medical Department
NEW JERSEY
STATE TEACHERS COLLEGE
AT MONTCLAIR

June 28, 1943

ANNUAL REPORT OF THE MEDICAL DEPARTMENT
1942 - 1943

. Trends and Developments

The work of this year has followed the general program of last year which includes:

(a) Physical examinations of 861 students
(b) Follow-up of Medical Recommendations and Corrections of Physical Defects found (detailed report is attached)
(c) Improving physical efficiency of individual students referred to Medical Department from other departments
(d) Tuberculosis Survey - Patch test and subsequent chest x-ray where indicated (Entire student body and new personnel)
(e) Hearing tests (Audiometer 4-A) of entire student body
(f) Basal Metabolism tests made 21
(g) Service rendered:

1.	First Aid treatments	1626
2.	Dormitory Care of	225
3.	Issuance of Make-up slips for illness	1513
4.	Office Consultations	1350

(h) Communication with private physicians re: improving physical efficiency of students

In addition we have followed the trend of the times in organizing the college in the care of possible air raids or sabotage. This includes the formation of First Aid squads for each of the four buildings. (List of the First Aid squads is attached); the equipment of four portable First Aid metal kits; instruction in First Aid given to 202 students.

. Enrollment Data - Undergraduates - Total - 696

I. Staff and Staff Changes

The Medical Department has consisted of one full time non-resident physician and one full time resident nurse. A part time resident student nurse assisted in the Medical Department from September to May 18, 1943.

. Recommendations

(a) Continue services of part time student assistant nurse, if possible. If this is impossible due to present shortage of nurses, the employment of one female and one male student to carry trays.
(b) Adequate infirmary facilities

Respectfully submitted,

Margaret M. Wurts

Margaret M. Wurts
College Physician

B

Follow-up of Medical Recommendations and Correction of Physical Defects found - 1942-1943

	Number of Defects	Number of Defects fully or partially corrected
Blood(Anemia,etc.)	18	11
Blood Pressure (Elevated)	16	6
Endocrine	57	31
Eyes	308	64
Feet	129	3
Gastro-intestinal System	33	3
Glands (Lymph)	57	2
Hearing	8	1
Heart	66	
Hernia and Varicocele	5	
Lungs	4	1
Nerves	75	6
Nose	19	1
Orthopedic (not feet)	33	1
Posture	69	
Skin	146	7
Speech	5	1
Teeth and Gums	109	41
Tonsils	52	4
Weight (Over and under)	84	27

Defects corrected were chiefly:

1. Eyes - Proper glasses
2. Teeth - Dental Care
3. Endocrine and Weight Abnormalities - Supervision by Medical Department, including diet, basal metabolism tests and gland therapy when indicated.

Defects uncorrected were due chiefly to:

1. Failure to report to Medical Department although defect was actually corrected.

2. Lack of interest on part of some students

3. Some defects are impossible of correction, such as missing teeth; loss of vision due to muscle imbalance; deafness due to childhood ear infection.

$ 6-1-43

First Aid Squads on Call for Air Raids and Air Raid Drills

Campbell, Carolyn, Captain of all Squads

Administration Building

Rainbold, Gertrude, Captain
Wetjen, Mary Louise, Co-captain
Alper, Ruth
Allen, Edith

Chapin Hall

Horton, Hope, Captain
McNally, George, Co-captain
Merkler, Irene
~~Xaidarxxx~~
Maher, Ruth

Russ Hall

Campbell, Carolyn, Captain
Harth, Jean, Co-captain
Jensen, Fay
Febrarro, Elsie
Wachter, Daniel

College High School

~~Xirxahingxxkx~~
Donnelly, Jane, Captain
Sterns, Ethel, Co-captain
Wilson, Doris

September 18, 1943

To:

Dr. Harry A. Sprague, Pres.,
State Teachers College,
Montclair, N. J.

ANNUAL REPORT OF THE DEPARTMENT OF BUSINESS EDUCATION FOR THE COLLEGE YEAR - 1942-1943

I. DEPARTMENTAL DEVELOPMENT

A. Curriculum

The curriculum offerings of the department were the same in 1942-1943 as they had been for the college year of 1941-1942. The required courses constitute a major in Social-Business and Accounting. The requirements, likewise, offer an opportunity for majors in other departments to obtain two eighteen point minors--one in social-business and the other in bookkeeping and accounting.

The following curriculum represents the required courses and suggested electives for all department majors:

	1st Semester	Freshman		2nd Semester	
Number	Title	Cr.	Number	Title	Cr.
B.E. 201	JR. BUS. TRAINING	4	B.E. 202	BUSINESS LAW I-II	4
		Sophomore			
B.E. 301A	BUSINESS LAW III	2	B.E. 303	BUSINESS MATHEMATICS	4
B.E. 301B	BUS. ORG. & MGMT.	2			
B.E. 304	Marketing	2			
		Junior			
B.E. 405	BKKPG. & ACCOUNTING	4	B.E. 407	PRIN. OF ACCOUNTING	4
S.S. 301	Economics I	4	Geog 302	Economic Geography	4
		Senior			
B.E. 401	THE TCHG. OF BUS. ED.	3		STUDENT TEACHING	10
B.E. 302	SALESMANSHIP	4			
B.E. 409	Consumer Education	2	B.E. 406	BUSINESS ECONOMICS	2
B. E 411	Cost Accounting	2			

Key:
Course titles capitalized indicate the required courses.
Course titles underlined indicate suggested electives.

It will be noted that two of the suggested elective courses represent course offerings in two other departments of the college. These two courses are definitely related to the field of social-business and accounting and add valuable breadth of training for all majors. In addition, these courses are usu-

ally found in the commercial department curriculum of the secondary schools. Consequently, many of the seniors, who have completed this additional training, have been assigned one or the other during their practice-teaching period. The two courses are:

Social Studies	301	Economics I	4 cr.
Geography	302	Economic Geography	4 cr.

Considering the required work and the elctives, the social-business and accounting majors have been able to obtain a well-rounded training in these two fields of commercial education. The department majors that have been graduated since June, 1942, possessed 40-47 semester hours of credit in these fields plus ten or more weeks of practical business experience.

In the curriculum above, the required courses numbered 201, 202, 301A, 301B, 302, and 406 constitute the required work for a social-business minor of eighteen (18) semester hours of credit. Many of these minors elected to complete a semester's work in bookkeeping and accounting (B.E. 405) and the two-point course in consumer education (B.E. 409).

Courses numbered 201, 303, 405, 407, and 406, plus ten weeks of practical business experience, constitute the requirements for an accounting minor of eighteen (18) semester hours of credit. Many of these minors have completed the additional two-point course in cost accounting (B.E. 411)

B. Faculty

The permanent full-time staff in the department during the college year of 1942-1943 was as follows:

Professor Francis R. Geigle, Ed.D., Head.
Instructor Horace J. Sheppard, M. A.

Due to the size of the enrollment and the amount of required student supervision, it was necessary to employ a part-time instructor during the college year of 1942-1943. Mr. James W. Hogan was employed to teach three courses during the first semeter and one course in the second semester. During the second semester he assisted in the social studies department. Mr. Hogan was a graduate of Notre Dame University. He had received his M.A. degree at New York University and at the time was pursuing further graduate work at the University. He was employed as a part-time instructor at the Packard Schol of Business, New York City.

II. DEPARTMENT DATA FOR 1942-1943

A. Course Offerings and Enrollments

Summer Session

Number	Title	Cr.	Enrollment
Twelve Weeks			
201	Junior Business Training	4	18
302	Salesmanship	4	13
401	The Teaching of Business Education	3	16
405	Bookkeeping and Accounting	4	37
411A	Cost Accounting	2	16
First Six Weeks			
301B	Business Organization and Mgmt.	2	21
304	Marketing	2	15
Second Six Weeks			
301A	Business Law III	2	20
409	Consumer Education	2	9

Fall Semester

201	Junior Business Training	4	32
301A	Business Law III	2	15
301B	Business Organization and Mgmt.	2	12
303	Business Mathematics	4	30
401	The Teaching of Business Education	3	18
405	Bookkeeping & Accounting	4	14
406	*Business Economics	2	22
407	Principles of Accounting (2 sect.)	4	32

Spring Semester

202	Business Law I-II (2 sections)	4	41
301A	Business Law III	2	10
301B	Business Organization & Mgmt.	2	6
405	Bookkeeping and Accounting	4	27
406	*Business Economics	2	26
407	Principles of Accounting	4	7
409	*Consumer Education	2	12

* (These courses were offered for the senior majors and minors during the last six weeks of each semester following the period of student-teaching).

The average student enrollment per class for the summer session

E. Department Majors of the 93 Business Minors

Department		No.
Social Studies		34
English		26
Mathematics		26
Languages:		
Latin	4	
French	2	
Spanish	1	7
Total		93

III. OTHER DEPARTMENT INFORMATION

A. Business Experience

Due to war-time conditions it has been relatively easy for the business majors and accounting minors to obtain the required ten weeks of practical business experience. The records indicate that the majority of these students obtain much more than the required ten weeks. In addition, most of them are able to obtain experience that has a direct relation to their colllege training.

B. Observations

The business majors continue to be handicapped in obtaining a suitable amount of worthwhile obsesvations. A great deal of this is done in the College High School. Due to the lack of business courses in the College High School, however, this type of observation is not completely satisfactory. Insofar as it is possible, some of the gbservations are made in the local or home-town high schools during the junior and senior years.

According to the reports of the juniors and seniors, the schools have cooperated splendidly and seem glad to have them and welcome the visitation and observation. In some respects, this type of observation is very valuable to these stduents. They feel that they are able to observe the exact conditions under which they will be required to do their student-teaching. It is impossible, however, to require any large amount of observation under these circumstances. The required number of observations of the department do not approximate the required observations in other departments of the college.

C. Extension and Summer School

The department did not offer extension or summer school courses for in-service teachers during the college year of 1942-1943. During the last six weeks of the summer session, however, one or two in-service teachers were enrolled in one of the courses.

IV. RECOMMENDATIONS

1. The amount of useful classroom material and the department supply of high school textbooks have continued to increase. It is very important that this material be filed in some central location in order that it can be located readily and made available for student use. The textbooks and supple-

mentary materials are of particular importance in the professionalization of subject-matter in all business courses. In addition, two full-time teachers and one part-time teacher should have some place for staff conferences as well as conferences with business students. The head of the department interviews each student, both majors and minors, in the department at least once a year. A business education office is of utmost importance and it is recommended that such an office be provided.

2. It is recommended that the department begin to consider the offering of graduate courses in Business Education as a possible post-war development. The failure of extension and summer school courses in the past is partially due to the lack of such a program. In addition the number of graduates of the business department is gradually increasing and they should be given the opportunity of continuing their graduate study at Montclair. During the past few years many in-service teachers have inquired about it and it is obvious that the college has a definite service to perform in this respect.

3. Around the first of every year a form letter goes out from the State Department to the principals of the public schools, describing the offerings of the State Teachers Colleges. In the past this letter did not list Social-Business and Accounting as a major at Montclair.

Montclair has now graduated three groups of students with this major and so-stated on their diplomas. It is, therefore, recommended that such a listing be made in order to provide the principals with complete information. This would materially aid Montclair in the recruitment of students, the selection of students, and the placement of graduates in the service area.

VI. "A Study of the Preparation of Commercial Teachers in the Public Secondary Schools of New Jersey."

In February, 1943, the writer completed the above study in partial fulfillment of the requirements of the Degree of Doctor of Education in the School of Education of New York University. Some of the statistical data of this study have a definite bearing on the work of the department and, consequently, are being submitted as part of this annual departmental report.

A. Scope of the Study

The study represents the analysis of completed questionnaires received from 900 of the 1,296 full-time commercial teachers and 90 of the 179 part-time commercial teachers in the public secondary schools of New Jersey during the school year of 1939-1940.

B. Sources of Supply of New Jersey Commercial Teachers

Eight hundred forty of the 900 commercial teachers indicated on the questionnaire the institution of graduation. The study revealed that 326 or 38.8 per cent were trained in New Jersey institutions, and 514 or 61.2 per cent were trained in institutions in 30 other states and the District of Columbia. The data did reveal, however, the tendency in the later years for the high schools of New Jersey to employ a proportionately higher number of commercial teachers trained in New Jersey.

C. Graduate Degrees

Two hundred twenty-seven of the 900 full-time commercial teachers hold graduate degrees. One hundred eighty-seven, or 82 per cent of these teachers received their graduate degrees in 17 out-of-state institutions, while, 40, or 18 per cent received the degree in New Jersey institutions.

These data are submitted in support of recommendation No. 2 page 6.

D. Semester Hours of Credit Possessed by Beginning Commercial Teachers

In major subject-matter specialization, 553 commercial teachers reported a median of 30 semester hours and a mode of 24 semester hours. In minor subject-matter specialization, 392 commercial teachers reported a median of 16 semester hours and a mode of 12 semester hours for a first minor, and 226 reported a median of 12 semester hours and a mode of 12 semester hours for a second minor.

E. Combinations of Commercial Subjects Taught

It has been said by superintendents, principals, and heads of high school commercial departments that combinations, within the specialized fields of commercial education, do not appear frequently enough to justify the specialization in a teacher-training program. The data show, however, that there is a demand for teachers trained in the specialized fields of commercial education--secretarial, bockkeeping and accounting, and social-business.

In the study, the writer made an analysis of the number of times the ten most frequently taught commercial subjects--junior business training, typewriting, bhorthand, bookkeeping, office practice, commercial geography, commercial law, commercial arithmetic, economics, and salesmanship--appeared alone and in combination with each other in the teaching assignments of the 900 commercial teachers. This analysis revealed that:

Five hundred thirty-one, or 59.0 per cent were teaching secretarial or social-business subjects or a combination of the two.

Four hundred eighty-one, or 53.4 per cent were teaching secretarial and/or bookkeeping and accounting subjects.

Three hundred sixty-two, or 40.2 per cent were teaching bookkeeping and accounting and/or social-business subjects.

Only 52, or 5.8 per cent were teaching subjects that are commonly classified in the three specialized fields of commercial education.

F. Combinations of Part-Time Commercial Teachers

The data revealed that social studies and mathematics are the most common subjects found in combination with commercial subjects in the teaching programs of the 179 part-time commercial teachers. One hundred eleven or 62.1 per cent of these teachers were assigned either social studies or mathematics and commercial subjects during the school year of 1939-1940.

Respectfully submitted,

Francis R. Geigle

Francis R. Geigle
Director of Business Education

ANNUAL REPORT
DEPARTMENT OF ENGLISH
1942-1943

I. TRENDS AND DEVELOPMENTS

A review of the activities of the Department of English during the college year, July 1, 1942, to July 1, 1943, will indicate adjustments demanded of a nation and college at war. First, the attempt to anticipate needs of secondary school teachers by providing in the 1942 summer session courses emphasizing the present problems of American democracy, and the important contributions of English literature to the development of the democratic spirit. Summer school students did not take advantage of the opportunities offered by these war-time courses but registered for the academic courses designated by conventional requirements for advanced standing in the Department. Such courses were designed to implement the suggestions of the Victory Corps for English activities in the secondary schools and to provide for high school boys and girls a body of interesting discussion materials concerning the development of the American Way of Life.

Secondly, further study of the examination given to candidates for the Master's degree in English. An examination of the objective type was substituted in April, 1943, for the close inspection of minute details which had formerly marked the examination. Revisions of graduate programs of study were made, progress toward sponsorship for the Master's degree by individual members of the Department was fostered, and the recognized needs of present-day secondary school teachers was emphasized.

Thirdly, the reallocation of the instructional load of Associate Professor Paul Hamilton, who was granted leave of absence to assume active duty as Captain in the United States Army. This vacancy, coming near the beginning of the second semester, was filled by distribution of his duties among various members of the Department. Until Mrs. Headley was secured,

the Eighth Grade of the College High School, formerly taught by Captain Hamilton, was taught by the head of the Department. College High School Dramatic Club direction was assumed by Mr. Bohn, and regular college classes and supervision were assumed by Dr. Krause, Mr. Pettegrove, and Mr. Conrad. Disposition of this work has been made for the school year beginning September 1943, but recommendations under Section VII state the position of the head of the Department concerning English faculty replacements.

A further extension of service was offered to the Department when two classes were graduated within the school year. This acceleration placed double responsibility of supervision upon the Department. During the first semester, approximately 40 students were supervised by Mr. Nickerson and Mr. Hamilton. In the second semester, the supervision of 43 English majors was divided among the members of the Department, with Mr. Nickerson again assuming major responsibilities. The head of the Department undertook the supervision in the more remote areas of the state which could best be reached by train and bus.

Public relations activities of the college, under the direction of Mr. Pettegrove and the assistance of Mrs. Lipsitz, paid special attention through releases to local and state papers to the work done by the College in the national emergency. Especially noteworthy were the releases on the Red Cross Blood Bank, the student labor utilized by farmers, and the second Victory book drive. Mr. Hogan, who was to furnish time and experience to the publicity work of the college, was prevented by illness from the assumption of these duties.

The work in Dramatics under Mr. Bohn resulted in a production in the Mount Hebron Junior High School, of Oscar Wilde's "The Importance of Being Earnest". Despite frequent changes in the cast, due to withdrawal of men for military service, the production was favorably received by a large audience.

At the request of several interested high schools, the annual Drama Day was held in the auditorium of the College High School. The production of our own College High School Dramatic Club received special commendation from the judges.

The preparation of slides for use in the Art Appreciation sections of the Freshman orientation course in World Literature continues. Dr. Cayley has retained photographic privileges in various New York museums which have enabled him to make this collection an interesting and useful one to freshman students. He is now engaged in securing illustrative materials for the required courses in American Literature.

The head of the Department served as one of the principal judges for the state-wide Poetry Reading Contest held each year by the University of Newark; and both Mr. Nickerson and the head of the Department served as judges for the semi-final and final Constitutional Oratorical Contest conducted by the American Legion.

The work in Speech has continued under Dr. Ogg, and 12 seniors were graduated in February who had fulfilled the requirements for a minor in Speech. The Speech Playhouse continued its bi-weekly meetings of original creative compositions in the field of Speech.

Mr. Nickerson presented six evenings of poetry vespers in the college amphitheatre during the months of July and August, 1942. His course in English 444, Radio in the Classroom, provided a laboratory for the presentation of original scripts prepared by the League of Women Voters, over Station WPAT. These programs have been duly recorded by Mr. Nickerson and are available for use in the classroom, or for publicity purposes. Mr. Nickerson retained time on the air for college publicity purposes by undertaking an original program, The Dream Peddler, WPAT, Sunday, 7:45.

Special mention must be made of the extraordinary services of the Library Staff to the Department of English. The work of Miss Cook, Dr. Heimers,

and Mrs. Winchester in implementing courses given by the head of the Department increased considerably their several duties, but their contributions are so practical and helpful that he frequently requested their assistance.

Miss Cook, in addition to giving at least three hours to each Freshman English section in order to acquaint them with library contents, methods, and practices, met with Senior methods classes to discuss professional materials, teaching aids, and in-service teaching assistance. In the summer session of 1943, she participated in directing the Workshop in Literature for Adolescents. She and Mrs. Winchester are now prepared to offer this course to summer school students if regular staff assignment cannot be made.

Dr. Heimers met Senior methods classes to present the philosophy and methodology of Visual Aids in the teaching of English. She contributed materials and suggestions which were utilized in the preparation of lesson plans and units of work. Senior English majors are required to spend at least three hours in the Visual Aids Library in order to examine personally some of the materials recommended in Dr. Heimers' well-known Bibliography of Audio-Visual Aids in English Language and Literature.

To Mrs. Winchester falls the arduous but pleasant task of supervising the English Bulletin Board displays, one of which was so favorably reviewed in the Montclair Times of August 12, 1943. These constitute a major requirement of the work of the methods class, which in the summer session included fifteen experienced teachers. With undergraduates she also discussed the English teacher's role in personal guidance, the recreational reading of boys and girls, and the artistic make-up of books for adolescent reading.

The English Department is proud of the rapidly growing daily circulation, of the Library, the low percentage of loss through theft and student carelessness, the courteous service of an under-manned and over-worked staff, and most of all the availibility and accessibility of the contents of a library of which both College and State can be proud.

II. ENROLLMENT OF MAJORS AND MINORS

Seniors	Jan. 1943	- Majors 24	Minors 5
	May 1943	- Majors 14	Minors 4
	Aug. 1943	- Majors 26	Minors 25
Juniors	Jan. 1944	- Majors 13	Minors 2
	June 1944	- Majors 40	Minors 27
Sophomores		- Majors 36	Minors 21
Freshmen		- Majors 10	Minors 5

Speech Minors: Total at the present time - 9

Three English majors graduated in January, 1943 cum Laude; four members of the English Department graduated in May, 1943 cum Laude. The degree of Master of Arts was conferred upon six candidates from the Department of English in May, 1943.

III. COURSES TAUGHT DURING 1942-1943

Summer Session, 1942

Course Number	Title	Semester Hours	No. Sections	Average Size	Instructor
Undergraduate Courses					
S204	Extemporaneous Speech	2	1	2	Ogg
S208	Fundamentals of Speech, II	2	1	2	Ogg
S301A	Adolescent Literature	2	1	9	Hamilton
Graduate Courses					
S401W	Teaching of English in the Secondary Schools	2	1	13	Hamilton
S402A	Survey of English Literature	2	1	2	Krauss
S402B	Survey of English Literature	2	1	2	Krauss
S421	Short Story	2	1	21	Conrad
S442A	American Literature, I	2	1	11	Conrad
S442B	American Literature, II	2	1	11	Conrad
S448	Choral Speaking	2	1	6	Ogg
S450	Contribution of American Drama to American Democracy	2	1	10	Bohn
S452	Conflicting Cultures in Contemporary Life	2	1	6	Cayley

In the summer of 1942 the following courses were offered but did not fill:

S414	Public Relations and School Publicity	2	Pettegrove
S431A	Shakespeare and the English Drama, I	2	Bohn

Course Number	Title	Semester Hours	No. Sections	Average Size	Instructor
S454	English Literature and the Rise of Modern Democracy	2			Pettegrove
S503	Geoffrey Chaucer and His Times	2			Krauss
S506	John Milton	2			Hamilton
	Total Enrollment			91	

Fall Semester, 1942

Undergraduate Courses

100A	World Literature	2	5	24	Bohn 1 Cayley 1 Krauss 3
100B	World Literature	3	1	7	Bohn
101	The Language Arts	4	2	31	Conrad 2
200A	English Composition	2	5	14	Pettegrove 1 McKinney 4
200B	Fundamentals of Speech	2	3	25	Ogg 3
201	British and American Poetry	4	2	28	Pettegrove 1 Nickerson 1
301B	Shakespeare's Major Plays	2	2	12	Krauss 1 Bohn 1
310	Journalism	2	1	9	Pettegrove
401	Teaching of English in the Secondary Schools	3	1	43	Fulcomer
402	Survey of British Literature	4	1	27	Krauss
407	British and American Biography	2	1	25	Conrad
408	Creative Composition	2	1	4	Conrad
410	Major Speech Defects	2	1	4	Ogg
413	Modern Poetry	2	1	7	Nickerson
417	Teaching of Speech	2	1	3	Ogg
438	Masters of American Literature	2	1	9	Fulcomer
451	Art and Literature in Western Culture	2	1	23	Cayley

Graduate Courses

A324	Correction of Minor Speech Defects	2	1	10	Ogg
A431B	Shakespeare and the English Drama, II	2	1	10	Hamilton
A432	The Development of the Drama	2	1	10	Bohn
A517	Recent Research and Experiment in the Teaching of English	2	1	16	Fulcomer
	Total Enrollment			614	

The following courses were offered in the part-time division but did not fill.

A518	The Major Romantic Poets	2			Cayley

Twenty-four English majors were awarded the degree of Bachelor of Arts in January, 1943; fourteen in May, 1943.

Course Number	Title	Semester Hours	No. Sections	Average Size	Instructor
	Spring Semester, 1943				
	Undergraduate Courses				
100A	World Literature	3	1	43	Fulcomer
100B	World Literature	3	7	28	Bohn 2 Cayley 2 Krauss 2 Pettegrove 1
102	British and American Drama	4	2	31	Bohn 2
200A	English Composition	2	4	18	McKinney 3 Pettegrove 1
200B	Fundamentals of Speech	2	4	16	Ogg 4
202	British and American Fiction	4	2	35	Conrad 1 Krauss 1
301B	Shakespeare	2	1	12	Krauss
404	Survey of British Literature	2	1	16	Krauss
407	British and American Biography	2	1	44	Conrad
410	Major Speech Defects	2	1	6	Ogg
419	Grammar for Teachers	2	1	18	Fulcomer
421	The Short Story	2	1	10	Conrad
426	Victorian Novel	2	1	6	Pettegrove
441	Medieval Epic, Romance, Saga	2	1	7	Krauss
442	American Literature	4	1	24	Conrad
444	Radio in the Class Room	2	1	9	Nickerson
451	Literature and Art in Western Culture	2	1	8	Cayley
	Graduate Courses				
A406	Modern Novel	2	1	11	Conrad
A413	Modern Poetry	2	1	10	Nickerson
A503	Chaucer and His Times	2	1	10	Krauss
	The following courses did not fill:				
A516	Language Problems in the English Curriculum				Pettegrove
	Accelerated Summer Session, 1943 **First six weeks**				
	Undergraduate Courses				
201	British and American Poetry from Chaucer to Frost	2	1	29	Nickerson
208	Speech Fundamentals	2	1	9	Fulcomer
301B	Shakespeare	2	1	17	Bohn
302	Survey of American Literature	2	1	22	Cayley
322	Oral Interpretation	2	1	18	Fulcomer
405	Victorian Poets	2	1	6	Nickerson
413	Modern Poetry	2	1	9	Nickerson
435	Play Production	2	1	13	Bohn
447A	Introduction to Philosophy, I	2	1	14	Cayley

The following candidates received the degree of Master of Arts at the Commencement Exercises in May, 1943:

Lois Hardifer Damon
Mildred Kaboch Headley
Dorothy Mary McKaig
Muriel E. Vanderhoof
Francis Charles Walter
Dorothy E. Wilson

During the year seven candidates for the Master's degree in English were matriculated in the department:

M. Alice Crawford
Ann Pekovic
Mrs. Vivian W. Dunn
Mrs. Rose D. Koches
Eleanor Noyes
Anita Marie Sabella
Jane Sriel

Total Enrollment for the Spring Semester, 1943	670
Total Enrollment for the Accelerated Summer Session, 1943	157
Total Enrollment for the entire year beginning Summer Session, 1942, through Accelerated Summer Session, 1943	1512

IV. STAFF AND STAFF CHANGES

The permanent staff during the year included:

Professor	Edwin S. Fulcomer, Ed.D., Head
Associate Professor	Lawrence H. Conrad, A.M.
"	William Paul Hamilton, A.M.
"	Russell Krauss, Ph.D.
"	Paul S. Nickerson, A.M.
Assistant Professor	Harold C. Bohn, A.M.
"	Harry G. Bayley, Ed.D.
"	Mary Eula McKinney, A.M.
"	James Parker Pettegrove, A.M.
Instructor	Helen Loree Ogg, Ph.D.

Mrs. Mildred Headley, appointed as an instructor to replace Mr. Hamilton in the Eighth Grade, College High School, resigned at the end of the regular school year.

Miss Helen Pfutzner served as secretary and assistant during the first semester. At the request of the heads of several of the departments, Miss Pfutzner was transferred to the mimeographing office, and the services of the secretary of the Dean were offered to the English Department.

Miss Geralding Smith, N.Y.A. assistant to the head of the Department in charge of filing and recording of English observations in the College High School, was graduated with the Class of May, 1943.

V. TEACHING IN THE COLLEGE HIGH SCHOOL

During the fall and spring semesters, the following staff members had assignments in the College High School; each class carried a credit of four semester-hours on the total teaching load:

Grade 7 - Mr. Nickerson
Grade 8 - Mr. Hamilton and Mrs. Headley
Grade 9 - Dr. Fulcomer
Grade 10 - Mr. Conrad
Grade 11 - Mr. Pettegrove
Grade 12 - Mr. Bohn

VI. RECOMMENDATIONS

A. Personnel

For the advancement of the work in Drama, particularly in the stage craft training necessary for high school coaching of dramatics, I recommend that Mr. Bohn be provided with an assistant to relieve him of any responsibility save the actual direction of plays. This instructor should give such courses as English 312 - Acting, Directing and Makeup, and English 435 - Play Production. He should be responsible for the public production and public performances of Players, and direct the College High School Dramatic Club. Such courses could be used as the State requirement in Dramatics for a Speech minor. A part-time assistant is all that is now indicated for this activity.

For the improvement of instruction in the College High School, and in order to relieve members of the staff for graduate study, writing, and for graduate work in the College, I recommend the appointment of a competent high school instructor to assume responsibility for one junior and one senior high school class and a home room in the College High School. This instructor might teach two courses in the College, these to be determined by department needs rather than replacement of Captain Hamilton since other members of the Department are adequately equipped to teach his courses.

Secretarial help of competent training and experience should be available to the head of the Department for a minimum of four hours per week. Since N.Y.A. aid is to be discontinued, the head of the Department urges that Miss Anne Kobryn be secured by the head of the Department as student assistant and that Miss Elizabeth Tepper be reassigned as assistant to Mr. Pettegrove for typing public relations releases of the College. When possible, assistance should be offered to Dr. Cayley for the preparation of slides.

B. Instructional Improvement.

The Composition Clinic indicated for a number of our students throughout the four levels of college work is again recommended. Students majoring in all Departments should be assigned by their instructors for the remedial and corrective work which their written compositions indicate.

The style book, prepared at the request of heads of the Departments and described in the Report to the President for the year 1941-42, is still unavailable. If printing costs prevent publication at this time, this style book should be mimeographed and sold to each student as the composition standard for the students of New Jersey State Teachers College at Montclair.

Several courses designed to meet particular needs of high school teachers of the present day received insufficient enrollment to form a class. I recommend the continued offering of such courses for both undergraduate and graduate students, and urge that prospective candidates for the Master's degree incorporate several of these courses among the more conservative offerings of the Department. I also recommend a new seminar at the graduate level - English 519, The English Curriculum in the Modern Secondary School, which will take under discussion such items as the Victory Corps Program, Pre-Induction Courses, Integration of School and Industry, and the Integration of Personality to Modern Life

through Literature. This course should be introduced in the spring of 1944. Such a course can shift its emphasis to meet the changing needs of the high school curriculum.

C. Graduate Study

The Department proposes to offer to candidates for the Master's degree a third alternative, namely, the requirement of two additional hours in lieu of the comprehensive examination now given to such candidates. This would enable candidates to take 32 points and prepare a thesis, or 32 points and take a comprehensive examination, or 34 points - at least 20 within the Department of English - without thesis or examination. This policy, which has been successful at both Teachers College, Columbia University, and at New York University, is now urgently requested by both graduate and undergraduate students.

Although improvement has been made in the type and organization of the examination now offered to the candidates for the Master's degree in the field of English, it still remains an academic experience almost completely unrelated to teaching secondary school. The head of the Department proposes that, after 16 points in the Department of English have been taken, an objective type comprehensive examination be offered to candidates for the purpose of determining what further courses in the Department are needed to satisfy Department requirements. If competence is established, no more than 20 points in English should be urged upon the candidate, allowing him at least 14 points of elective courses. At the present time many candidates carry 26 points in the Department of English, and have no elective choices save two in the Department of Integration.

The Department strongly urges the College to guarantee at least two courses in the Graduate Division of the Department in each of the three sessions. These courses would provide 12 points of graduate study

in a calendar year and enable candidates for the Master's degree in English to meet Department requirements within one and a half years. Liberalizing of the adherence to work sheets set up by former heads of the Department is now under way, but there is a strong desire upon the part of many candidates to follow the program of studies originally designated. This occasions considerable embarrassment both to the Department and to the candidate when the desired course fails to secure the number of students necessary to continue the course.

VII. STUDIES MADE AND STATISTICAL DATA

An experimental procedure was adopted for freshmen entering in January, 1943, when the heads of the Social Studies and English Departments joined in offering a correlated program. The instructors met for frequent conferences, visited each other's classes, and discussed assignments in order to prevent duplication. A class of 43 freshmen provided an interesting unit in which to make this experiment. Both Professor Hatch and the head of the Department were gratified with the results of this experiment which was particularly interesting since meetings of the English section had been reduced from three to two per week in order to provide additional training and experience in Physical Education for men and women in the accelerated program. An analysis of freshman spelling abilities was undertaken at the request of Dr. Morrison.*

The shortened school year made objective testing of this group impossible, but it is the belief of the head of the Department that, instead of loss in skills sought at the freshman level, there was an actual gain in competence because of this coordinated effort. Continuation of this innovation, particularly with small groups of freshmen entering at odd times, is therefore recommended. When the group is very small, they may be assimilated in the regular freshman groups, but when the number is large enough to provide a workable unit (any number between 25 and 50), freshmen will profit

*Results are tabulated in an appended letter from the head of the Department to Dr. Hugh Morrison.

from the joint efforts of the heads of the Departments of Social Studies and English. Certainly, it is the ardent desire of Professor Hatch and of Professor Fulcomer to continue their experiment of the spring of 1943.

During the year, the cooperative English tests in Mechanics, Effectiveness of Expression, and Reading Comprehension were administered to all sophomore students at the college level. A report by Miss Pedersen, of the Advisory Service of the Cooperative Test Bureau, indicates that the norms of this class in Mechanics was .8 above the norms of end-of-the-year sophomores; in Effectiveness 4.2 above this level; in total Reading Comprehension 4.8 above. Miss Pedersen had this to say about these results: "The majority of the high scores fall above the 99th percentile of scores made by seniors in college. On the Mechanics test, the lowest score exceeds three percent of the scores made by the students who have completed one year of study in college English. Similar results are observed in the scores of the Effectiveness of Expression test, which indicates that the range of ability and achievement of your students is very wide."

VIII. COLLEGE HIGH SCHOOL

Various innovations, resulting from the testing program begun in the year 1941-42, were attempted in the College High School. The 9th Grade combined English, Social Studies and Art in a unified program called "Western Culture". This was a study of South American and Central American Geography, History and Literature. Considerable attention was devoted to the Art of this area, but no full-time instruction was available for complete integration of this work into the total program of the 9th Grade. The year's work culminated in a P.T.A. meeting addressed jointly by Dr. Snyder and Dr. Fulcomer, who discussed the philosophy and methodology of such coordination of subject matter. For this occasion the 9th Grade classroom was turned into a museum in which the individual and collective work of the class was on display for the High School, the College and the Parent-Teacher audience. So successful

was this experiment that it is to be continued for the school year 1943-44, with the complete approval of Mr. Arthur Seybold, Principal, and the Parent-Teacher group of the College High School.

At the 11th Grade, Mr. Pettegrove, serving as advisor to the High School publications, spent the first semester on an analysis of newspapers and how to read them, using the publication of College high Crier as a demonstration of the theories studied in the text book.

Mr. [illegible], in order to develop attitudes of cooperation and to experiment with a group learning situation, produced a melodrama of the 19th Century, "There's Gold in the Hills" or "The Dead Sister's Secret", as a major activity of the work of the senior class. The play was presented for three nights in the College High School auditorium as a means of providing a scholarship fund for disposition by the High School and College. This was a successful venture of personal integration of individual members into the group whole, of dramatic performance, and of school finance.

Mr. Conrad's 10th Grade class produced a joint composition enterprise entitled "A View of Fifty-two". This was mimeographed, bound, and sold by members of the class to defray the cost of publication. Copies of this publication were sent to the President of the National Council of Teachers of English, to high school superintendents throughout the State, and to the Department of Secondary Education of the State Department.

To continue the collection of objective evidence of the qualify and nature of English instruction in the College High School, the battery-testing instituted in 1942 was continued at the 7th and 12th Grade levels. The results of this limited testing program indicate satisfactory achievement upon the part of the 12th Grade in English fundamentals and an adherence to the high standards of selection of 7th Grade students. Copies of these test results are appended.

Respectfully submitted,

Edwin S Fulcomer

May 19, 1943

Dr. Robert H. Morrison
Director of Teacher Education
Trenton Trust Building
Trenton, New Jersey

Dear Dr. Morrison:

I am enclosing herewith a record of our college freshmen admitted in January of 1943, who have taken the test on "Words Frequently Misspelled by College Freshmen" supplied by your office in your letter of February 17th.

These words were given at various intervals, and the number dictated each time was not sufficient to admit of frequency of error due to fatigue. Both the students and I found the list interesting, and they were very willing to cooperate in providing this information for your office.

The scores range from 244 to 321, and the midpoint or Median score fell between 290 and 292. The distribution of first Quartile scores is as follows:

English majors................	5
Social Studies majors.........	2
Mathematics majors............	1
Business Education majors.....	1
Science majors................	1
Language majors...............	1

A complete distribution of scores by majors will be made by my department.

I am eager to learn how the scores of this freshman class, a rather heterogeneous group, will compare with those of entering freshman classes in the other state teachers colleges.

Cordially yours,

Edwin S. Fulcomer,
Chairman of the English Dept.

ESF/hw
Enc.

GRADE 12, FORM B

Names	IOWA SILENT READING National Grade Equivalents	ESSENTIALS OF ENGLISH Nat. 75 Percentile 122 Nat. Median 112 School Median 109.54 Class Median 114 Range 69 - 139.5
Bennett, John		97
Bluestein, Doris		106
Boyle, Robert		124.5
Carlson, Ned		111
Chaplin, Betty		123
Cushman, Margaret		108
Fehr, Patricia		114
Fisher, Lee		
Gardner, Barbara		98
Geller, Bernice		69
Glenn, Rosemary		118
Haubenstock, Alan		114
King, Elizabeth		110
Kron, Virginia		103
Mooney, Jane		109
O'Grady, Phyllis		113.5
Peppinghaus, Audrey		116
Pratt, Truxton		116.5
Purcell, Dorothy		114
Roy, Betty-Jo		123
Samuel, Robert		105
Scheel, Chilton		139.5
Silver, Elisabeth		130
Smith, Scott		100
Wallace, Jane		136
Waugh, Beverly		121

Names	National Grade Equivalents: 58.5 equals Gr. 7 School Median 79.13 Class Median 75 Range 60 - 91	Nat. 75 Percentile 84 National Median 72 School Median 109.54 Class Median 81 Range 69 - 110
Baker, Barbara	82	94
Durget, Physllis	78	87
Elk, Herbert	70	80
Fay, William	75	75
Fischer, Donald	61	80
Flanders, Peggy	84	96
Gump, Linda	85	94
Habernickel, Irene	72	95
Haupt, Norma	73	86
Kerr, Bob	74	79
Lane, William	91	90
Liss, George	73	71
Lewis, Nancy	60	69
Mason, Janet	75	110
Nagel, Bill	78	78
Peterson, Anne	60	80
Peterson, Edythe	70	79
Stanton, Virginia	85	94
VanEss, Robert	76	88
Varick, Jack		80
Vermeulen, Gladys	76	81
Waterman, Dick	74	73
Wells, Carolyn	82	82

GEOGRAPHY

Annual Departmental Report to the President

During the academic year 1942-1943 some 336 people took courses in geography. Of this total, 44 were geography minors. In addition there were 15 of the part-time students working out geography minors.

The total number of geography minors is small this year than it was during the academic year 1941-1942. This is largely explained by the lose of practically all of our male student population. Heretofore, male students comprised from one third to two-thirds of the geography minors.

Below is a list of the courses given during the academic year 1942-1943 and the summer of 1943, and the number of people enrolled in the various courses.

		Number of Sections	Number Enrolled
Science 100	Physiography	6	216
Science 417	Meteorology	3	36
Geography 201	Climatology	1	11
Geography 202	Western Hemisphere	1	27
Geography 301	Eurasia	1	12
Geography 302	Economic Geography	1	24
Geography 413	Caribbean America	1	10
	Totals	14	336

Summer Session 1943 Accelerated Program

Science 100	Physiography	1	43
Science 417	Meteorology	1	11
Geography 201	Western Hemisphere	1	9
Geography 302	Economic Geography	1	21
	Totals	4	84

In addition to the regular academic year, 84 people had courses in geography during the accelerated summer session of 1943. Of this number 22 are geography minors.

When the war ends, I anticipate a marked increase in the enrollment of both men and women in geography throughout the entire United States.

Our current program in geography is satisfactory as far as it goes, but it does not reach enough people and especially the people who need the point of view and the particular discipline that geography offers.

At present, the Officer Candidate Schools require more geography of the men and women in attendance than we do at Montclair. Yet we are supposed to be a professional institution training students to go out into the school systems of the state to give the young people a world point of view.

Many of our problems of national and international concern, often possessing vital geographic implications, are decided on the basis of whether you are a Democrat or a Republican. The result of this kind of thinking is that Congress does not know where our interests lie. In other words, they reflect the opinion of a nation of geographic illiterates, and that condition endangers hopes for solving post-war problems.

The great need of the world today is a "rational economy" based on facts. The people of the nation should understand that one country cannot prosper if others are not prospering. Applications of geographic information will help to provide realistic answers to our reciprocal

trade program, our good neighbor policy, international air route policies, aid to China and our relations in general with the other nations of the world.

In most colleges physiography, which involves a great deal of map interpretation, and meteorology are at present the most popular courses in geography. These courses, with climatology added, are basic to further work in geography and should be continued after the war as a part of the curriculum in geography. In addition, courses in regional, economic and political geography should become increasingly important in our scheme of education.

In my report of 1942 I recommended that more geography be required. During the academic year 1942-1943 I sent a letter to the President requesting more time for geography for all students. Again I should like to recommend that more geography be required of the entire student body.

Respectfully submitted,
H. P. M.
Harley P. Milstead

DEPARTMENT OF INTEGRATION
REPORT TO THE PRESIDENT

August 13, 1943

I. TRENDS AND DEVELOPMENTS

1. STUDENT-TEACHING. The accelerated program brings about a shortened period of student-teaching, as well as a reduction in the amount of supervision which the college can furnish. Under the circumstances, it is impossible to keep this important activity of the College at the level which we should all like to maintain. Beyond redoubling our efforts to improve it, there is little that we can do just now to avoid a modicum of deterioration. But it is important that all hands keep the higher standards in mind and, as soon as we return to normal schedule, restore the former allotment of time and personnel to student-teaching.

2. OUR END-PRODUCT. In the time that I have been on the faculty, two widely different sets of circumstances have tended to minimize the value of the College as a teacher training institution. Until two years ago, the unemployment situation condemned a majority of our graduates to go through a long period of vocational idleness or seek employment in other kinds of work. Thus the College came to be, for the typical graduate, an opportunity for liberal arts education rather than professional education. More recently, teaching positions in the state have gone begging because our graduates have preferred to avail themselves of the abundant opportunities for other kinds of employment near their homes. So, again, we find the Montclair training functioning as a liberal arts education rather than as professional education.

There are two probable results of this trend: first, the school superintendents will question our effectiveness as an agency for providing high school teachers; second, the students themselves will regard the professional courses of the College as so much extraneous matter.

I confess that I do not know just what to do about it. But I am impressed with the casual attitude which the graduates take toward their pledge to teach three years in the state. Dr. Smith comments upon the situation in his report, appended hereto.

3. GRADUATE PROGRAM. The decrease in graduate enrollment which was reported last year continues. There is some consolation in the fact that we seem to retain the esteem of many persons who hold positions of importance in the schools and who come here to increase their usefulness. If we can keep this nucleus, the return of peace will see a revival of full patronage.

II. ENROLLMENT DATA

1. New matriculations by academic years, September 1 to August 31.

1935-36	21 Matriculations	1939-40	49 Matriculations
1936-37	29 "	1940-41	35 "
1937-38	46 "	1941-42	20 "
1938-39	52 "	1942-43	21 "

2. Total Active Matriculations on file:

	September 1, 1942	September 1, 1943
Personnel and Guidance	38	43
Administration and Supv.	97	92
Total	135	135

3. Summer enrollment in graduate classes:

Summer 1941	296 registrations
Summer 1942	215 "
Summer 1943	160 "

III. STAFF AND STAFF CHANGES

The only changes are in the list of invited instructors. The reduced graduate registration has almost eliminated it. This summer, for example, we have but one: Mr. Roy Zimmerman.

IV. RECOMMENDATIONS

1. READING CLINIC. If Dr. Sperle's work in reading is to be continued, she should be given a room which can serve as her office and laboratory.

2. OBSERVATION IN COLLEGE HIGH SCHOOL. The members of this department have commented upon the difficulty of finding, in many periods of the College High School program, instruction suitable for observation. Part-time and even novice teaching are said to constitute, at times, the only available demonstration offering. It is the recommendation of the department that the personnel and schedule be arranged with the importance of observation in mind.

H H Ryan

PLACEMENT REPORT

Classes which graduated in May 1942 and in January 1943 have for the most part been placed, most of them in teaching positions. The May class and the August class of 1943 have been entirely placed in the fields of mathematics and science. The placements in English, social studies, and foreign languages and business are moving slowly for the following reasons:

1. High school enrollments during 1943 have been dropping significantly due to the drafting of 18 year-olds and the opportunities for war service and industrial employment.

2. For reasons which may or may not be satisfactory, the graduates of these recent classes refuse to apply for teaching positions which would take them away from home. This is accentuated at this time, no doubt, by the fact that boys have been drafted into the army, girls have gone into the WAVES and the WAC, and parents are putting pressure on the remaining children to stay at home.

At this time we find it necessary to consult with the candidates before we send out their credentials, because in so many cases they do not wish to apply. The result is that we are forced to write letters stating that we regret that we have no applicants at this time for the position.

If more minors in mathematics and science could be built up, we could render better service to the state and also improve our placement record.

W. Scott Smith

August 13, 1943

Annual Report of the Language Department

State Teachers College--Montclair,New Jersey

September 1943

A.Trends and Developments.

The Language Department at Montclair differs from the other departments in our college by being a composite of activities in four distinct language fields,each field being really worthy of a separate report. I shall therefore discuss each division by itself.

Before particularizing I should like to make some general statements regarding the entire language field.

In the first place the impact of the war has been seriously felt by each language field:in some cases, notably Spanish and Linguistics,beneficially;in the other fields,detrimentally.General discussion of the lines of learning most essential to the war effort has emphasized certain studies to the point where only these have seemed imperative. The Victory Corps program has noted very slightly, indeed,almost to the vanishing point,the need for a knowledge of foreign languages.The curtailment of foreign language courses in the high schools has been the inevitable result.

Despite the fact that all our enemies speak foreign languages,that English is the native language of only one of our allies,and the further brutal fact that our soldiers need to know something of the foreign languages with which they come in contact no demand has been made by the Manpower Commission that all prospective members of the armed forces should get some training in the foreign language field in the high schools.

Instead the government is going to great expense to prepare wordbooks in the different foreign languages to be carried in the soldiers' pockets for consultation in moments of crisis. So committed is the government to this plan that exhaustive tests of print paper are being made to insure these pocket wordbooks against any kind of disintegration. And all this extra effort at a time when a fine body of trained language teachers is at hand and ready to reorganize foreign language courses to meet the war needs.

Were this war to be fought in English speaking areas alone,the course of the government would be pardonable.To date none of our battles have taken place in such areas and there is no clear prospect that future battles will either. I brought this matter to the attention of Manpower Commissioner McNutt in a personal letter,only to receive a courteous but none the less definite brushoff from a member of his research staff. Real regard for the situation should be reflected in a demand by the government for foreign language

training in the high schools, especially in French, German and Spanish. The postwar problems which are already apparent would suggest the advisability of adding training in other languages at once, notably Russian, Portuguese, Japanese and Chinese. And this language training should be taught by the Direct Method, the method which has been employed at Montclair for the last fifteen years. By this method the basic facts of foreign civilizations are picked up at the time proficiency in speaking is being acquired.

The Montclair language department is blazing the trail in the direction I have outlined by the introduction of the WAR LANGUAGES course. Miss Littlefield, an expert in linguistics, has inaugurated the study of some dozen foreign languages with the assistance of linguaphone records. She has added liveliness to this work by assembling a corps of helpers who actually speak the various languages being studied. The setting up of the WAR LANGUAGES course accords with our conviction that what is now being given but scant recognition will in time be regarded as an absolutely essential element in the equipment of Americans about to enter the armed forces or who will, following the war, be engaged in the work of rehabilitation in foreign lands.

With respect to the trends and developments in each language division I have the following to record:

1. The Latin curriculum has been maintained at its usual high level. It goes without saying that certain changes in emphasis have been occasioned by the war' Much more time has been allotted to the geographical aspects of the study due to increased interest in the locations of ancient and modern military activities. No chance has been lost to draw lessons from the ancient field to provoke discussions of contemporary problems. It has been possible to integrate the ancient and modern worlds much more successfully than in times of peace. More emphasis has been laid on word study because of the low level of attainment shown by the army vocabulary tests. Examination of these socalled English vocabulary tests reveals that they are in large part tests in camouflaged Latin and Greek rather than in English. Miss Littlefield is still conducting extra curricular work in Greek. A knowledge of Greek is very valuable to serious students; it is practically essential to the equipment of the expert teacher of Latin. It would be an excellent addition to the armament of teachers of English.

2. The Spanish curriculum is attracting a greater number of candidates each year. This is due to the skilful presentation of Miss de Escoriaza, to the larger number of high school students trained in Spanish, to a more widely distributed interest in Latin American relations and to the close contact of our Spanish courses with present trends. Long before the interest in Latin America became prominent Miss de Escoriaza, sensing what was coming, reorganized our Spanish offerings with emphasis on Latin America. Without adequate textbooks she constructed her own, prepared mimeographed copies and perfected her courses by carefully controlled experimentation. As a result our Spanish graduates

have been employed in government censorship work, a concrete evidence of the excellence of our Spanish curriculum.

3. The French curriculum has weathered the present storm very well at Montclair. It would be folly to set down that we have not felt the pressure on French which has been so wide spread in the country. Too many students have thought that French had lost its significance as a study because France had been defeated. This trend has changed now as a result of the rebirth of France in North Africa and the presence of French armies on the allied side. In the meanwhile our French offerings have been maintained on the usual high standard. The work of the French division has been impaired to some extent by the absence of Miss Tonone during the fall semester and the necessity for hiring substitute teachers. Great credit is due to Mde. Cressey for filling in willingly at every critical moment.

4. The Language Curriculum has presented its usual offerings in Methods and the Foundations of Language. A new and important course, WAR LANGUAGES, was added this year to the Language offerings. This course, made possible at Montclair only because of Miss Littlefield's skill in phonetics and linguistics, is directly geared to the national war effort. For this work Miss Littlefield attended extension courses in New York City, secured special equipment, and assembled guest teachers from our student body and from the vicinity of Montclair. Her enthusiasm led to great interest in this course and consequently to a considerable class registration. I regard this course as very important and trust that consideration may be given toward making it a genezal requirement following the pattern of the Foundation of Language course.

B. Enrollment Data

1. Undergraduate

	Sept-Jan				Jan-May			
French:	101	202	402	404	102	301	404	
	11	14	12	15	13	13	7	
Latin:	101	202	402	404	102	301	404	
	7	10	9	13	5	10	13	
Spanish:	101	102	202	404	102	201	301	404
	13	9	10	6	14	12	7	3
Language:	401	300	War Lang.		300	War Lang.		
	19	90	15		90	15		

2. Graduate

There are no graguate courses offered by the Language Department. This results from two primary causes: (1) the time available to the members of the staff is completely occupied by the undergraduate courses, (2) the present ruling of the college administration that for the A.M. degree in the language field

16 semester hours of language work on the graduate level must be offered, of which only 8 may be transferred from another collegiate institution, leaves an 8 hour requirement to be supplied by our college. As these 8 hours are unavailable it is impossible for the Language Department to attract graduate students. It is true that three A.M. degrees in language work were granted this year. These were based for the most part on the work of candidates who in prewar years studied for a year abroad under our Exchange arrangement. For this year of study they were granted the required 16 semester hours in their language field.

C. Staff and Staff Changes

The Language Department staff for the past year has been:

W.H.Freeman	Department Head and Professor of Languages
Teresa de Escoriaza	Ass't Professor of French and Spanish
Germaine P.Cressey	" " " "
Valentine Tonone	" " " "
Ethel F.Littlefield	Assoc. " " Languages
Lydia Caliandro	Instructor in High School Latin

Substitute teachers for Miss Tonone
Paulette P.Lipsitz
Mde.Germaine Weill
Mrs.Florence Borden

I should like to call attention to the outstanding work of Mrs.Cressey and Miss Escoriaza. For many years these two teachers have been bearing the burden of the work in French and Spanish with conspicuous success. We would find it difficult if not impossible to replace either of them in case of a change. In view of their high reputation for scholarship and the fact that no advance in professorial rating has been accorded them for many years I recommend that each be elevated in rank to that of Associate Professor in their separate fields.

D. Recommendations

In the first part of this report I presented an overall picture of the state of the department and the difficulties under which we work because of the pressure of the war. The initial confusion due to the emphasis on essential war training is, I believe, coming to a close. Experiment is revealing that pressure cannot successfully tra transform a language-minded into one mathematically-minded and that great injustice is done by demanding that this be attempted. Pupils thus forcibly directed into channels of study for which they have little or no aptitude become educational misfits and start on a long trail of personal failure. I recommend that every advantage of the possible return to sanity be taken through extra stimulation of students of cultural subjects-especially of languages. This may take the form of setting apart a certain number of state scholarships for award to language students. It would make quite a difference to the language enrollment if there could be some French, Spanish or Latin scholarships, so identified.

I recommend that attention again be directed to the matter of inaugurating beginning classes in the language field with college credit at Montclair. The curtailment of language courses

in the high schools has had the effect of partially drying up the sources of candidates of advanced standing in language study.Third and fourth year high school language classes are being discontinued because of the war. The realization of this loss in advanced candidates suggested the need for accepting good students with only two years of high school language study as members of the department.This move is so recent that exact results cannot be stated. We would prefer to have this experiment paralleled by the opening of classes in beginning foreign languages. That these would be eminently successful is evidenced by the experience gained in connection with the special beginners'class in Spanish. Our students who have taken this uncredited Spanish course have made better progress than those who have come to us with two years of high school Spanish. Much of Miss Escoriaza's work with high school trained students has been in attempting to purify that training.

I recommend also that every effort be made to advance the cause of our War Languages course as a splendid means of assisting our young people toward a better understanding of the nations with whom we shall be closely associated both during and after this war.

E. Studies made and Statistical Data bearing on the work of the department

During the year a definite attempt was made by the head of the department to collect data regarding the employment of its graduates and the possibility of recruiting its members for substitute work in view of the teacher shortage. A questionnaire was sent out to every past language major.Request was also made for data regarding their war activities either Voluntary or remunerated.The replies received were numerous but not complete. Not one of the replies indicated apathy toward the war effort. Many graduates had left the teaching field for actual participation in war industry and all had given some part of their time to voluntary work.

Carefully collected data regarding the activities of our language graduates now in the armed forces revealed that many are being used not as ordinary soldiers but as instructors. It is reassuring to the staff that the army has seen fit to use our language majors in positions of responsibility and trust.

W H Freeman Ph. D.
W. H. Freeman
Department Head

August 30 1943

REPORT OF MATHEMATICS DEPARTMENT
FOR
ACADEMIC YEAR ENDING
SEPTEMBER 15, 1943

I. TRENDS AND DEVELOPMENTS

The national emergency has been increasingly important in modifying and directing the functions of the Department of Mathematics. These influences have been particularly noticeable in (1) The war-time duties of both members of the staff and of students because of the increased length of the school year or because of outside work in war industries or in special duties related to the war effort leave less leisure for college activities. (2) The accelerated program and the rapid absorption of young men in the army has seriously affected the size of the upper classes. This, in turn, has made difficult the operation of extra-curricular affairs.

Despite these influences, there has been no serious interference with the objectives of the Department of Mathematics in training secondary school teachers of mathematics and in providing services - frequently in relation to war-time emergencies - to the secondary schools of the state and of the nation.

There is considerable evidence to show that many of the war-time activities of members of the mathematics staff have greatly enriched the experience of those members and have resulted in positive and valuable contributions to teaching methods. The most noteworthy of these contributions is probably the greater use of those practical applications of mathematics which help to professionalize the teaching of mathematics. Experience has shown that college students, even mathematics majors, are not always able to make direct transfer of their learning to practical situations. Contact by the instructor with many such situations gives assurance that practical uses of mathematics will not be slighted in the class room.

Incidental to the war effort is the large correspondence between members of the staff and former students of the college who are now in war

service. With some members of the staff, this correspondence is heavy and while it takes considerable time, is considered well worthwhile.

Individual contributions by staff members to the war effort or to the service of teachers in the State of New Jersey are worth noting. Several members of the department had the opportunity to address high school teachers on a number of occasions.

Dr. Davis was elected President of the Association of Mathematics Teachers of New Jersey and has arranged an interesting program that deals with war problems in teaching for the Fall meeting of this association.

Mr. Clifford taught a course in Engineering Mathematics and in Business Statistics for the Wright Aeronautical Corporation and in Quality Control Statistics for the Radio Corporation of America. All of these courses were given under the auspices of Rutgers University. Mr. Clifford also took the following courses: Statistics in Management, Columbia University; Quality Control Statistics, New York University; Quality Control Statistics, War Production Board. He is working as a part-time Research Statistician for the Wright Aeronautical Corporation.

Dr. Fehr was appointed a member of the State Curriculum Advisory Committee which published a report advising high school principals and teachers how courses could be modified to meet war needs. Dr. Fehr also, in collaboration with the Head of the Department, published an article on Mathematical Education in War-Time. This was published in the Mathematics Teacher November, 1942, and was reprinted in the Educational Digest of February, 1943. A reprint is attached to this report.

Dr. Hildebrandt is chairman of a committee of the National Council of Teachers of Mathematics on Multi-Sensory Aids. The report of this committee is in press and will be published as the Nineteenth Year-Book of the Council. Dr. Hildebrandt also taught a class in plane and spherical trigonometry and another one in use of the slide rule and in blueprint reading at

the Montclair Adult Education School. These classes were especially designed for workers in war industries and for young men planning to enter special services of the armed forces. Applications of trigonometry to navigation were stressed in the former course and fundamentals of mathematics needed in industry in the latter.

The Head of the Mathematics Department was requested early in December, 1942, by the U. S. Armed Forces Institute, to modigy his algebra text to workbook form for the use of members of the armed forces. He was assisted in this task by Dr. Fehr. He was also asked by the United States Office of Education in collaboration with the War Department Pre-Induction Training Branch, A.S.F., to serve on a committee to study pre-induction needs in mathematics. The report of this committee was published in the March 1, 1942 issue of the Mathematics Teacher, in the April, 1942 issue of Education for Victory, and in the April issue of the Bulletin of Secondary School Principals. Later the War Department asked him to act as chairman of another committee to make a further study of this same problem. This study involved visits by the committee to a large number of Army camps during the past summer. The report is published in the October, 1943 issue of the Mathematics Teacher and will be issued as a manual by the War Department. Abstracts have appeared or will appear in Education for Victory, the American Mathematical Monthly and other educational papers. Reprints of these reports are attached hereto. Addresses on war problems in teaching mathematics were made to Section 19 of the New York Society for the Experimental Study of Education and to the New Jersey Association of Teachers of Mathematics as well as to smaller groups of teachers.

Reports from members of the department showing modifications made in courses because of the war follow:

DR. DAVID R. DAVIS

In order to meet the present war-time needs of students of mathematics, the changes indicated below have been made in the following courses. The chief difference, however, in the teaching of these courses arises in the nature of the applications and problem material. The theory and general character of the mathematics involved are essentially the same as have been included in these standard courses.

College High School - Eleventh Year

1. The fundamentals of algebra are thoroughly treated with emphasis upon the processes involved. Applications to war-time problems are stressed.

2. More elementary analytic geometry is introduced, especially the properties of conic sections, and numerous applications of this material are given.

3. Greater correlation of elementary algebra with plane geometry is made and alternative methods of solving practical problems are considered.

4. More work is given in practical trigonometry than is usually included in such a course.

5. The theory and applications of logarithms are thoroughly studied.

6. Problems are selected from standard material in aeronautics, air and marine navigation, field and shop work, meteorology, transportation and supply, etc.

MATHEMATICS 101-102: MATHEMATICAL ANALYSIS -- FIRST YEAR COLLEGE MATHEMATICS - COLLEGE ALGEBRA - TRIGONOMETRY - ANALYTIC GEOMETRY - AND ELEMENTARY CALCULUS

1. The standard material in college algebra is treated with numerous applications to science and war-time mathematics.

2. Logarithms and their applications are thoroughly considered.

3. Permutations, combinations, and probability with many practical applications in science and statistical analysis receive careful attention.

4. The function concept and its implications are emphasized throughout the course.

5. Elementary work in calculus is introduced involving simple problems in differentiation and integration. Numberous practical applications are made involving average and exact rates of change of a function, tangent to a curve, slope of a curve, areas, volumes, etc. Problems are selected from Chemistry, Physics, Biology, Meteorology, Artillery Mathematics, etc.

6. Methods of graphing functions accurately and quickly are studied in connection with the applications and interpretations of graphs.

7. The fundamental principles of trigonometry and their numerous applications in various branches of war-time mathematics are carefully treated.

8. A full treatment of analytic geometry is given together with its numerous practical applications. Trigonometry and elementary calculus are used throughout.

9. The elementary calculus is used to facilitate, simplify, and augment the treatment of practical problems.

10. Special consideration is given to higher plane curves, parametric equations, and polar coordinates.

MATHEMATICS 301: THEORY OF EQUATIONS

1. Special methods for solving the various classes of polynomial equations are studied with emphasis upon the solution of practical problems.

2. The possibility of a geometrical construction for the regular n-gon is completely characterized. Practical applications are given and constructions are outlined.

3. Newton's method for obtaining the irrational real roots of an equation receives careful attention.

4. The properties of determinants and matrices are thoroughly studied together with their applications to problems arising in mathematics and in other fields.

5. Solutions of systems of linear non-homogeneous equations and of linear homogeneous equations are fully treated. Corresponding properties of linear independence and of linear dependence of equations and functions are considered

and applications to problems are limited only by time.

MATHEMATICS 402: SOLID ANALYTIC GEOMETRY

1. The fundamental principles of solid analytic geometry are studied and applied. Allied space problems from the various fields of science are selected for treatment.

2. The theory and application of partial differentiation are used in considering space problems in geometry, physics, mechanics, etc.

3. Problems in maximizing or minimizing a function of two independent variables with some practical applications are treated.

4. Some consideration is given to directional derivatives and their applications especially when this leads to the simplification of the treatment of problems.

5. Multiple integration and its various applications with the solution of specialized problems are included in this course when time permits.

MATHEMATICS 528: CRYPTOLOGY, CODES, AND CODE MESSAGES

1. The basic elementary principles of the theory of numbers which are essential for the modern theory of cryptology are carefully studied, special attention being given to the solution of linear congruences and simultaneous linear congruences.

2. The transmission of code messages through the medium of linear congruences is thoroughly treated.

DR. HOWARD F. FEHR

Besides teaching the prescribed curriculum in the regular courses, the following additional services and courses have been rendered the academic year 1942-1943.

I offered to teachers in service, two courses in navigation covering marine and air dead-reckoning navigation, and astronomy and celestial navigation.

College High School - Twelfth Year

The course in mathematics was modified to include military and naval applications, and special stress on applications to physics. This enabled the boys to enter the V-12, A-12, and specialized services with good standing.

MATHEMATICS 601: EMERGENCY WORKSHOP

This course was given to nine teachers for retraining in mathematics to meet the teacher shortage in this field. Stress was given to fundamental principles in this work.

MATHEMATICS 404: READINGS AND LECTURES IN MATHEMATICS

The seniors who graduated in February were given a six-week course in specific mathematical education for war-time training. This included industrial, technical, navigational, and ballistics mathematics.

DR. E. H. C. HILDEBRANDT

College High School - Eighth Year

A study of aircraft was introduced. Identification of planes was taught with the purpose of cooperating with agencies interested in this civilian defense work. In addition, simple problems relating to air navigation were discussed and solved graphically, e.g. the wind velocity triangles. After a review of latitude and longitude, various types of map projections were discussed and simple ones constructed with ruler and compasses. These included the Mercator and the polar gnomonic projection. The projection on the cuboactahedron which appeared in Life Magazine was assembled by several members of the class.

Instruction was given in the use of the slide rule and students were required to check as many problems as possible with this instrument. This resulted in a most satisfactory unit and the slide rule became more than just a device for motivation.

Construction of graphs was allotted additional time including elementary problems in surveying as well as the graphical solution of typical

problems found in army tactics.

MATHEMATICS 101, 102: MATHEMATICAL ANALYSIS

Applications of mathematics to war problems were stressed throughout the course. Among these were problems in navigation, great circle sailing, celestial navigation, path of a projectile, map projections and their uses, rate-time-distance, as well as a fundamental understanding of the slide rule.

MATHEMATICS 201, 202: CALCULUS

Particular stress was placed on such problems as those in physics and related fields which were typical of those found in need at this time.

NAVIGATION

A sixteen week course, as part of the aeronautics program for the Civil Aeronautics Authority for training high school teachers, included sixteen one hour lectures and examinations. A large number of films used by the navy and air corps for instructional purposes was shown and other worthwhile materials which may be used effectively by teachers in their high school teaching of navigation, were stressed.

MR. PAUL C. CLIFFORD

College High School - Ninth Year

Considerable stress was put on trigonometry. Simple problems from avigation and navigation were included. Some of these problems were solved by scale drawing as well as by trigonometry.

Formulas from different branches of engineering were used in studying the function concept. As far as possible, the meaning of different terms involving engineering concepts were explained.

More stress than usual was put on numerical work. Many of the algebraic identities were set up after considerable experimentation with corresponding numerical examples.

MATHEMATICS 300: SOCIAL USES OF MATHEMATICS

1. All students in this course were required to learn the full use of the Mannheim slide rule. I have had more comments on this simple innovation than

I expected.

2. Considerable emphasis was put on the collection, graphical presentation, and interpretation of data. This was intended to include a study of a few simple machine blueprints.

3. The elements of scale drawing and approximate measurement were studied with some indications given of the military significance.

4. Students were required to achieve a higher skill in fundamental arithmetic processes than heretofore.

5. Emphasis on the construction, use, and interpretation of tables was stressed.

In general I have found that the past year's experience has greatly broadened my horizon. It has improved my college teaching. For, I now have a much greater fund of practical applications both in business practice, in engineering, in quality control, in materials testing, and in psychological testing. This is hard to evaluate as an aid in teaching, but I realize its value as I find the class room illustrations change along with my experience.

DR. VIRGIL S. MALLORY

College High School - Tenth Year

The course in geometry continued to stress postulational thinking with examples of the effect on conclusions as fundamental assumptions change. While examples were largely taken from the field of geometry, many were given in the field of everyday thought. Variations to meet the war situation were largely in the employment of practical problems - air and sea navigation, vectors, locus, and such.

MATHEMATICS 401: TEACHING OF MATHEMATICS IN SECONDARY SCHOOLS

While the fundamental principles of teaching were stressed as usual, recognition was given to the need for those fundamental changes in high school teaching of mathematics which had been demonstrated by the war demands. Hence five war problems were discussed:

1. The Victory Corps Program and its implications for the teaching of mathematics.

2. The poor showing in arithmetic of inductees and the demonstrated need for such teaching in high schools.

3. The value of functional mathematics and the need for the development of high school courses in general mathematics.

4. The tendency in war-time for many students to elect sequential mathematics and the necessity for guiding only capable students into such courses.

5. The demonstrated lack of transfer to useful fields of many courses in sequential mathematics and the need for modification of such courses to useful ends.

II. ENROLLMENT DATA

Undergraduate

	Majors		Minors		Total	
	Oct. 1	Feb. 1	Oct. 1	Feb. 1	Oct. 1	Feb. 1
Freshmen	39	34	--	5	39	39
Sophomores	19	17	14	8	33	25
Juniors	25	12	9	2	34	14
Seniors	18	21	4	4	22	25
Total	101	84	27	19	128	103

Graduate

Majors	15
M.A. Degrees, May 1943	1

III. STAFF AND STAFF CHANGES

Mrs. Marie Damm replaced Miss Shirley Stamer as teacher of the seventh grade in the College High School. In January, Mrs. Damm had to leave and was replaced by Mrs. R. W. Mount.

Staff members and the courses taught were:

Fall Term

Dr. Mallory: High School (10th Grade), 401, and supervision of practice teachers.

Dr. Davis: High School (11th Grade), 101, 402, and supervision of practice teachers.

Dr. Fehr: High School (12th Grade), 302, 400, 101C, and 404.

Dr. Hildebrandt: High School (8th Grade), 101C, 201, and 400.

Mr. Clifford: High School (9th Grade), 101, 304, and 300.

Mrs. Damm: High School (7th Grade).

Spring Term

Dr. Mallory: High School (10th Grade), and supervision of practice teachers (2 sections).

Dr. Davis: High School (11th Grade), 101, 102, and supervision of practice teachers.

Dr. Fehr: High School (12th Grade), 102, 300, 301.

Dr. Hildebrandt: High School (8th Grade), 102, 202, 300, and 404.

Mr. Clifford: High School (9th Grade), 102, 300 (2 sections), and 304.

Mrs. Mount: High School (7th Grade).

IV. RECOMMENDATIONS

Office: The Mathematics Department is exceedingly cramped in its limited office space. In a room only ten feet by twenty feet, five instructors have desks. No other department offices are so cramped. This lack of space makes it difficult for staff members to adequately confer with students and severely handicaps their efficiency. In such limited quarters it is impossible for members of the department to do research work in the office.

Salaries: This problem has become exceedingly critical in the Department of Mathematics as it probably has in some other departments of the college. Unless some adequate adjustment is made, serious loss to the prestige of the college may result from the loss of staff members to other institutions. Staff members should rest assured of a continued increase in salary as their experience ripens and as their value to the state, in services rendered and in

prestige acquired, increases. Such recognition has not been given since 1930 and the present trend has already resulted in the situation that staff members at the college at Montclair with greater training and prestige are receiving smaller salaries than teachers in high schools with less experience and with much less ability. These staff members continue to lead, advise, and teach teachers in the public schools who are better paid than they are. That a high degree of esprit de corps is still maintained is due, not to the care of the State of New Jersey, but to the professional zeal of these staff members.

Respectfully submitted,

Virgil S. Mallory

Virgil S. Mallory
Head of the Mathematics
Department

Pre-Induction Courses in Mathematics

(Reprinted from The Mathematics Teacher for March 1943)

Pre-Induction Courses in Mathematics*

Foreword

The United States Office of Education has received urgent and repeated requests from individuals and organizations throughout the country to give the secondary schools detailed suggestions for the teaching of mathematics for pre-induction purposes. In December 1942, the Office in cooperation with the President of The National Council of Teachers of Mathematics appointed a committee to make a survey of the mathematical needs of the armed forces and upon this basis to make a report concerning what the schools can do for the emergency. The committee consisted of Virgil S. Mallory, Professor of Mathematics, New Jersey State Teachers College at Montclair; William D. Reeve, Professor of Mathematics, Teachers College, Columbia University; Giles M. Ruch, Chief, Research and Statistical Service, U. S. Office of Education; Raleigh Schorling, Professor of Education, University of Michigan; and Rolland R. Smith, Specialist in Mathematics for the Public Schools of Springfield, Massachusetts, and President of the National Council of Teachers of Mathematics. Dr. Smith served as chairman of the Committee.

Post-induction training in the armed forces is based in considerable measure on manuals of instruction prepared especially for the technical occupations of warfare. It was the thought of the Committee that detailed analyses of a large number of these technical and field manuals would provide a first approximation to the mathematical needs of the military establishments, or at least afford a basis for evaluating the general character of the curricular modifications in secondary school mathematics dictated by the emergency. To this end, the Committee requested and received the fullest cooperation of the Army, the Navy, and the Civil Aeronautics Administration.

The Civilian Pre-Induction Training Branch, Industrial Personnel Division, Services of Supply, War Department, selected approximately 50 of the Army instructional manuals covering occupations for which there is the greatest training need. These manuals were studied in detail and notes made of the various types of mathematics used, and of the mathematical background involved. In like manner the Committee analyzed about 20 Navy training manuals made available by the Training Division, Bureau of Naval Personnel, Navy Department. Similar consideration was given to the training materials of the Civil Aeronautics Administration. The mathematical needs of typical war production industries were also considered by examination of about 50 unit courses used in the Federal-State program of Vocational Training for War Production Workers conducted cooperatively by State Boards for Vocational Education and the U. S. Office of Education.

This report has been submitted to and approved by:

- The National Policy Committee for the High-School Victory Corps
- The Civilian Pre-Induction Training Branch, Industrial Personnel Division, Services of Supply, War Department
- The Training Division, Bureau of Naval Personnel, Navy Department
- The Civil Aeronautics Administration, Department of Commerce

John W. Studebaker
U. S. Commissioner of Education
Washington, D. C., February 1943

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* Reprints of this report may be had at 10¢ each postpaid from The Mathematics Teacher, 525 W. 120th St., New York, N. Y. Larger quantities may be had at a reduction.

Reasons for this Report

It is expected that the United States Army will increase to at least 7,500,000 by the end of 1943. The Navy and Coast Guard will in this period be enlarged by several hundred thousand. The total of all the armed forces may ultimately exceed 10,000,000. This further expansion in a mechanized war will increase the present shortage of men and women trained in mathematics and in practical physical science, in both the armed forces and the supporting war industries.

Of the men inducted into the Army, a large majority must be given some technical training in either pre-induction or post-induction courses. The Navy requires an equally high per cent of skilled personnel. The Navy operates nearly a hundred post-induction schools, and the Army a far greater number. An analysis of the various technical manuals used in these schools provides convincing evidence that much time is now wasted teaching simple mathematical principles and skills to many men who ought to know these things when they are inducted.

Many of the jobs classified as technical in the Army require only simple arithmetic. However, if one takes the technical manuals in the post-induction courses as a criterion, some of the least technical jobs require a level of mastery of mathematics higher than that needed by such workers in civilian life.

The technical manuals of the armed forces show that there are many mathematical applications that only the military organizations should teach, but it should not be necessary for them to give instruction in elementary mathematics.

The problem confronting mathematics teachers of the high school is "How can instruction in mathematics be modified, and that immediately, so as to give the utmost aid in the emergency?" The crux of the problem lies in what can be done for boys and girls now in the last one or two years of the secondary school. For this reason, detailed suggestions have been given for pupils of this group who are not now studying mathematics. The time factors for the students receive due recognition in the recommendations which follow. General suggestions are given for those enrolled in the sequential courses.

Recommendations

The emergency need for boys and girls trained in mathematics has focused attention on the highly technical features of our mechanized civilization. The armed services and the supporting war industries need boys and girls trained in the proficient use of mathematics ranging from a real mastery of arithmetic fundamentals and such practical uses as are found in courses in general mathematics to the uses of higher mathematics in meteorology, ballistics, and other branches of science. Girls trained in mathematics are needed to replace men in industrial and other civilian positions which require the same range of uses of mathematics.

This range of uses of mathematics is very wide. Every high school pupil must be able to compute with assurance and skill and many will be called on to use the simple algebra, informal geometry, scale drawing, and numerical trigonometry of the right triangle now taught in most courses in general mathematics. A smaller number will be needed who have mastered all of the sequential mathematics of the senior high school and college. The range of uses of mathematics is as wide as the abilities of high school boys and girls. Intelligent guidance should guarantee that every high school pupil study mathematics according to his need and his ability. The four-year sequence in mathematics, including trigonometry and solid geometry, should be taken by those students who have a real interest in mathematics, who are capable of mastery of the subject, or who are likely to use mathematics in their further training and ultimate occupation. Counselors must realize the need for certain mathematical skills and understandings.[1] On the other hand, it is wasteful to put pupils into such courses if their aptitudes and abilities indicate that they cannot obtain a secure mastery of the material they are studying. It should be remembered in every case that unless the mathematics taught is mastered thoroughly, it will neither be of practical use nor will it serve the other purposes of mathematical study.

The demands of the armed services and war industries for pupils well trained in mathematics are of immediate concern. These demands are equally urgent in the armed forces and in industrial production. They need not, however, conflict with the needs of boys and girls for adequate training in mathematics for future civilian life. The emergency calls for more effective teaching of mathematics with adequate practice and practical applications to the end that pupils can use mathematics in a wide variety of practical situations. Mathematics learned as mechanical manipulation only cannot have its fullest value either in the immediate emergency or in future civilian life.

The type of subject matter, the time element in teaching, and the number of practice exercises must be so selected and modified that a maximum of understanding is secured. Accuracy and skill in application must be a main consideration, not the amount of material covered. Instead of special courses in mathematics, practical problems can be used both to motivate and to point out emergency uses. Recommendations are made later concerning material which can safely be eliminated from the sequential courses to assure this more effective teaching as well as to permit the introduction of immediate applications to fit the emergency. Good teaching of mathematics, modified as suggested, is more valuable than specialized mathematics courses given by teachers not qualified to teach them, or taken by pupils who do not have the necessary foundation in mathematics and science or the maturity for their successful mastery.

Some modifications in content of the sequential courses are advisable both for the war emergency and for future civilian uses. The mathematics taught should be practical to the extent that it has immediate application, that it is needed for other essential mathematics, sciences, or other advanced courses, or that it pertains directly to the war effort. The immediate needs for war service should be met by reduction in the amount of less important material and the substitution of material which is more essential.

Recommendations for courses in mathematics are not confined to boys. Girls are needed to replace men in all branches of industry and civilian life in which mathematics from its simplest elements to its more advanced study is used. The need is great for women to fill vacancies as laboratory technicians and assistants, as junior engineers, as workers in industry, and in the teaching profession. There is also immediate need in civilian work, in the signal corps and in industry for girls who are high school graduates.

Finally, the high school is confronted with the need for effective guidance of boys and girls so each will study that mathematics which he can master and use effectively. Three general categories of pupils are recognized for purposes of the specific recommendations which follow.

1. *Pupils with little or no mathematical background.* This group consists of boys and girls who have had not more than one year of training in mathematics beyond the eighth grade. If these pupils are near

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[1] The following references will be useful to counselors and other guidance officers:

Victory Corps Series, *Guidance Manual for the High School Victory Corps.* In press. One free copy will be distributed to each high school when printed. Additional copies must be ordered from the Superintendent of Documents, Washington, D. C.

Minimum Essentials of the Individual Inventory in Guidance. By Giles M. Ruch and David Segel. U. S. Office of Education, Vocational Division, Bulletin No. 202. Occupational Information and Guidance Service Series No. 2. For sale by the Superintendent of Documents, Washington, D. C. Price, 15 cents.

graduation, induction, or employment, they should take work of the type suggested by the special one-semester course described on page 121. If they still have a year in school, they should take the special one-year course described on pages 117 to 121.

2. *Pupils who have studied mathematics for two years beyond the eighth grade but who are not now studying mathematics.* These pupils will ordinarily have had one year of algebra and one year of geometry. If they are near graduation, induction, or employment, they should take work of the type suggested by the special one-semester course described on page 121. If they still have a year in school, they should take the special one-year course (pages 117 to 121). For these pupils the one-year course can be more intensive than for those who have little background in mathematics.

3. *Pupils who are now enrolled in the four-year sequential mathematics courses.* The more capable of these pupils should continue in that work and should not substitute emergency courses in mathematics. The curricular modifications needed in the basic sequence in mathematics are those which will secure more effective teaching, permit the introduction of practical applications related to the war effort, and correct deficiencies in computational skill. Suggestions about material which may safely be omitted to make it possible to offer enrichment material and to introduce fundamentals of arithmetic and practical applications are given later. It should be realized that, under the impetus of the war, enrollments in this sequential work will tend to increase. This necessitates careful guidance and selection. These courses should be reserved for those who can pursue them with satisfaction and high achievement.

A Suggested Special One-Year Course

Because of the limited time available, the Committee had to choose between the alternatives of concentrating on the most critical phases of pre-induction courses in mathematics or attempting a full coverage of all phases of such training, thereby delaying publication so long that the report would have no usefulness during the present school year. The decision was reached to prepare a rather detailed outline of this special one-year course, leaving the way open to supplementary reports should the need develop.

The number of topics studied by any given class will depend upon the ability of the pupils. Many classes will be able to cover the entire outline. Mastery of selected topics is of greater value than superficial knowledge of this entire course.

Arithmetic

The importance of the fundamental arithmetical skills with integers, and fractions, both common and decimal, has been so generally accepted as a part of the training of every American citizen, that we should expect all pupils who go through our elementary schools to exhibit proficiency in such skills and their application. Many pupils, however, have been so poorly trained that there is a large number with little mastery of arithmetic. Such a situation should not be permitted to continue.

The fundamental processes with integers and fractions, both common and decimal, which are ordinarily taught in the first six grades of the elementary school furnish a basis for the real applications which should follow in the elementary and the secondary school. Arithmetic correlates well with algebra, informal geometry, and numerical trigonometry. All of these are important in solving wartime and peacetime problems.

A study of the various technical manuals suggests that both abstract drill and practical applications should be very simple. It is far better to build confidence and to strive for accuracy with simple illustrations than to confuse the pupils with involved computations that seldom, if ever, occur in the actual jobs of the fighting forces. This suggestion applies to the work in algebra and geometry as well as to arithmetic.

A detailed outline follows:

I. Whole numbers
  1. Reading and writing large numbers
  2. Computation
    a. Addition of not more than six addends with not more than six digits in each
    b. Subtraction with not more than six-digit numbers
    c. Multiplication with the multiplicand containing not more than five digits and the multiplier not more than three digits
    d. Division with not more than three-digit divisors
II. Common fractions and mixed numbers
  1. Meaning (including the meaning of a fraction as an indicated quotient)
  2. Fundamental operations—Denominators should be mainly powers of 2 up to 64
III. Decimals
  1. Meaning
  2. Place value in numbers
  3. Fundamental operations (limitations similar to those under computations with whole numbers under I above)
  4. Changing common fractions to their decimal equivalents and vice versa. Ability to use tables of equivalents
IV. Per cents
  The work on per cents can be improved by practical illustrations from aviation and shop practice. In the post-induction manuals uses are made of all three cases of percentage. Practice should be principally on the first two cases: Finding a certain per cent of a number and finding what per cent one number is of another. The groundwork for teaching the second case should be laid by comparing two numbers as common fractions and as decimals. The topic of ratio and proportion affords an opportunity for refreshing the comparison concept
V. Averages (arithmetic mean and median)
  1. Meaning
  2. Computation (ungrouped data)
VI. Square root (see page 121)
  1. By division (trial and error)
  2. By table (interpolation)
  3. By the algebraic method
VII. Information graphs
VIII. Scale drawings (see page 120.)
IX. Keeping simple accounts
X. Applied problems

Informal Geometry

Geometry has a double value, first as knowledge and second, as a way of thinking. The importance of geometry in giving information of value in the daily life of every well educated citizen has been neglected, if not entirely overlooked. In making an object of any kind, one must first conceive the object in order to avoid waste of time and material. He must know the shape and the relation of the various parts, must be able to measure them, and finally, to fit (locate) them in their proper places in the completed object.

In building a special one-year course it must be decided what values of geometry are paramount for the national emergency, what content material should be selected, and what methods should be used to facilitate its teaching. For this purpose, informal geometry should include:

> *Intuitive geometry*, where one looks at a figure and says that something is so because it could not be otherwise. Example, "If two straight lines intersect, the vertical angles are equal."
>
> *Experimental geometry*, such as cutting out a paper triangle, tearing off the angles and then placing them adjacent to show that their sum is 180°.
>
> *Observational geometry*, which consists of recognizing objects as typifying certain geometric forms, seeing certain relationships and important facts that exist between them, such as, "Any angle inscribed in a semicircle is a right angle," or, "If two parallel lines are cut by a transversal, the alternate interior angles are equal."
>
> *Geometric constructions* of a fundamental type, such as bisecting a line or an angle.

In this special one-year course teachers should realize that there will be little or no place for deductive proof. The early geometric knowledge of the race began with simple observations, intuitions, measurements of real objects, and recognitions of their relations to each other. The classification of such knowledge as the race had attained and the organization of the facts of their experience into a deductive science were outgrowths of man's earlier struggles. As with the race, so with the individual; the real experiences with the facts should come first and the more formal propositions and their logical proofs later. It is conviction in the minds of the pupils that should be sought. Few pupils can understand what they have not physically perceived.

In all of this work, the choice of content and the emphasis in instruction should be placed upon those topics which have a practical bearing in the ordinary affairs of daily life.

The content of this part of the course should consist of:

I. Geometry of form
  1. Shapes seen in nature
  2. Geometric concepts
    a. Point
    b. Line
      (1) Straight
      (2) Broken
      (3) Curve
      (4) Horizontal
      (5) Vertical
      (6) Parallel
      (7) Perpendicular
    c. Plane
      (1) Plane figures
        (a) Rectilinear — triangle (scalene, isosceles, and equilateral), quadrilateral (trapezoid, parallelogram, rectangle, square, and rhombus), and regular polygons
        (b) Curvilinear—circle, parabola, and ellipse
    d. Solid
      (1) Kinds
        (a) With plane faces—rectangular solid, prism, and pyramid
        (b) With curved faces—cylinder, cone, and sphere
    e. Angle
      (1) Measurement
      (2) Kinds
        (a) Acute
        (b) Right
        (c) Obtuse
        (d) Straight
  3. Similarity
    a. Types of similar figures
      (1) Triangles and other plane figures
      (2) Reduction or enlargement of similar figures
      (3) Photographs and maps
      (4) Scale drawings
  4. Congruent triangles (no proofs)
  5. Mechanical drawing
    a. Instruments to be used if they are available
      (1) Ruler graduated to thirty-secondths, to tenths of an inch, and to millimeters
      (2) Protractor
      (3) Compasses
      (4) Draftsman's instruments
        (a) Drawing board
        (b) T-square
        (c) Triangles (30°–60° and 45°–45°)
    b. Skills to be learned
      (1) Drawing angles with a protractor
      (2) Drawing parallel and perpendicular lines
      (3) Drawing rectilinear figures
  6. Constructions with ruler and compasses
    a. Circle
    b. Bisecting a line segment
    c. Bisecting an angle
    d. Copying an angle
    e. Dividing a line segment into more than two equal parts
    f. Constructing triangles, given
      (1) Three sides
      (2) Two sides and the included angle
      (3) Two angles and the included side
      (4) Two sides and an angle opposite one of them

II. Geometry of size
  1. Direct measurement
    a. Appreciation of the limits of accuracy in measurement and of the fact that all *measurement is approximate*
      (1) Limits of accuracy
      (2) Significant digits

        - (3) Rounding off to reasonable results
        - (4) Common sense checks
    - b. Estimating and measuring
        - (1) Lengths—using ruler, compasses, calipers, and squared paper
        - (2) Angles—using the protractor
        - (3) Area of regular and irregular figures using ruler, squared paper, and simple formulas
        - (4) Volume and capacity
        - (5) Weight—avoirdupois, Troy, and apothecary's
        - (6) Time, including the international 24-hour day
    - c. Applied problems
- 2. Indirect measurement
    - a. Scale drawing (commonly used in air and marine navigation)
        - (1) Reading and using scales
            - (a) Two forms: 1 in. =6 ft. or representative fraction (R.F.) 1/72
            - (b) Changing a scaled distance to its value in relation to the original object
            - (c) Determining proper scaled distance to represent an object
            - (d) Using grids (squared paper) to make scale drawings
            - (e) Using metric scales
            - (f) Using ordinary ruler marked with a scale
        - (2) Drawing geometric figures to scale
            - (a) Rectangles
            - (b) Triangles, given three sides, two angles and a side, two sides and included angle, two sides and the angle opposite one of the sides
            - (c) Using triangles (including oblique triangles) to solve surveying and navigation problems (See also under "use of vectors" below)
            - (d) Using lines drawn on a grid to solve distance, rate, and time problems
        - (3) Method of representing directions
            - (a) Mariners' compass
            - (b) Naval bearings
            - (c) Surveyors' bearings
        - (4) Use of vectors
            - (a) Using a line segment to represent by its length and direction a velocity or the amount and direction of a force
            - (b) Using vectors to solve problems
                Finding the resultant of two forces
                Finding heading and correction angle, given course, air speed, and wind velocity
                Finding heading, given course, speed, and current
                Finding wind velocity, given heading, ground speed, and drift angle
        - (5) Representation of front, top, and side views of simple objects.
    - b. Numerical trigonometry of the right trangle
        - (1) Development by a scale drawing of the tangent function for angles of 10°, 20°, 30°, . . . 70°
        - (2) Use of 3- or 4-place tables of tangents to solve right triangles given two legs, or a leg and an acute angle
        - (3) Development of sine and cosine functions by scale drawing for angles of 10°, 20°, 30°, . . . 80°
        - (4) Use of 3- or 4-place tables of sines and cosines to solve triangles, given hypotenuse and side, or hypotenuse and acute angle

Algebra

The main use of algebra is made in connection with literal notation, particularly in formulas and equations. Many topics generally taught in the sequential courses need not be taught in this special course. In particular the following topics should be omitted. Addition, subtraction, multiplication, and division of polynomials; special products; factoring, except the case of removing a common monomial factor; algebraic solution of simultaneous equations; quadratic equations, except the form $ax^2=k$; and so-called verbal problems. The level of difficulty of no topic should be greater than that required in commonly used formulas. This means that all topics should be held to the simplest examples.

A brief outline follows:

1. Symbolism .
   a. Letters as symbols for numbers
   b. Symbols of operation including exponents, radical signs, and parentheses
2. Formulas
   a. Meaning
   b. Evaluating formulas concerned with shop, industry, and the armed forces including aviation (This requires only a knowledge of the meaning of symbolism and skill in arithmetic)
3. Equations
   a. Simple types such as $3n=6$, $n+3=6$, $n-3=6$, $\frac{n}{3}=6$, $2n+3=7$, and $2n-3=7$
   b. Indirect use of the formula (substitution of given values and solution of resulting equation for the unknown)
4. Signed numbers
   a. Meaning and use
   b. Fundamental operations
   c. Equations which can be reduced to the form $ax+b=cx+d$ including those having a single parenthesis
5. Graphs
   a. Familiarity with the coordinate system
   b. Interpretation of many kinds of simple graphs
   c. Graphing linear formulas
   d. Solution of simultaneous equations (The intersection of two lines frequently furnishes the solution of problems in navigation)
6. Operations (only the simplest examples)
   a. Combining like terms
   b. Laws of positive integral exponents
   c. Removing parentheses
   d. Multiplying a polynomial by a monomial
   e. Division by a monomial
   f. Factoring (One case, taking out a common monomial factor)
   g. Algebraic fractions (No more difficult operations with fractions or fractional equations need be taught than those that are necessary for evaluating commonly used formulas)
   h. Ratio and proportion
   i. Radicals
      (1) Square root by computation
      (2) Square root by table (interpolation)
      (3) Simplifying radicals only as needed in using tables
      (4) Use in formulas
   j. Quadratic equations of the form $ax^2=k$

In the use of notation recognition should be given to the fact that many practical formulas make use of both capital and small letters and letters with subscripts, primes, and superscripts. In substitutions both common and decimal fractions as well as integers should be used. In equations both common and decimal fractions should occur as coefficients.

SPECIAL ONE-SEMESTER COURSE

This course is an emergency refresher course for high school pupils who are near graduation or induction but who are not at present studying mathematics. It should be realized that mathematical knowledge which the pupils do not possess cannot be refreshed. Hence, the material used in this course will depend on the previous training or lack of training of the pupils. For everyone it will contain the fundamentals of arithmetic after diagnostic tests have determined the needs of the pupils. For some, those with little or no mathematical background, this arithmetic plus certain essential topics from general mathematics such as scale drawing, including elements of blueprint reading, numerical trigonometry, informal geometry, and simple formulas and equations, will constitute the course.

For pupils who have had previous courses in algebra and geometry the refresher course should emphasize those aspects of mathematics that are particularly applicable and essential to the war effort. It should begin with the fundamentals of arithmetic. The review of algebra and geometry should reduce emphasis on operations with polynomials (eliminating long division completely)

The following should also be eliminated:

Special products and factoring (except monomial factors, and possibly the difference of two squares and the perfect trinomial square)

Fractions with other than monomial denominators

Complex fractions (the type of fraction retained should be that found in formulas in geometry, physics, and simple shop situations)

Equations containing artificial fractions

Complex work in radicals (the types of radicals retained should be those occurring in geometry, numerical trigonometry, and physics)

Quadratic equations (except those of the type $ax^2=k$)

Deductive logic in the establishment of geometric relations

In the small high school it may be necessary to teach pupils of varying backgrounds in the same classes. In the larger high school at least two situations should be recognized:

1. A course for those pupils who have had no high school mathematics or only a one-year course in general mathematics or algebra. This should contain, in addition to the first topic below, as many of the other topics as can be done effectively.
   - (a) Fundamentals of arithmetic to correct deficiencies discovered by diagnostic tests
   - (b) Topics from general mathematics including scale drawing leading to the elements of blueprint reading; numerical trigonometry and uses of the Pythagorean Theorem; informal geometry including constructions, congruence, and similarity; use of tables
   - (c) Many practical applications from aeronautics, navigation, and shop uses of mathematics[2]
2. A course for those who have had two years of mathematics. This should contain as many of the following topics as can be done well:
   - (a) Fundamentals of arithmetic to correct deficiencies discovered by diagnostic tests
   - (b) Review of previous courses in mathematics omitting deductive derivation of geometric theorems and many of the purely manipulative and highly complicated expressions in algebra as indicated previously
   - (c) Many applications from aeronautics, navigation, artillery fire, parallelogram of forces and triangle of velocities, shop uses of mathematics; use of tables and the slide rule

SEQUENTIAL COURSES

The sequential work includes four years of mathematics beyond the eighth grade (seventh grade in states with a seven-grade elementary school) and should include solid geometry and trigonometry. Schools which find it possible may offer for the more interested and capable of these pupils additional work in mathematical analysis including topics selected from advanced algebra, spherical trigonometry, and the elements of analytical geometry and the calculus.

Each year of the course should contain some work in the fundamentals of arithmetic to insure increasing speed and accuracy in computation. Even competent pupils enrolled in the sequential courses do not always have adequate skill in applying fundamentals to whole numbers, fractions, decimals, and per cents. In many schools the courses in algebra and geometry fail to maintain arithmetic skills. This work should not be aimless but should be skillfully selected practice to correct deficiencies made evident through diagnostic tests. This work in arithmetic has already been outlined in connection with the special one-year course.

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[2] A fertile source of both wartime and industrial applications is the Seventeenth Yearbook of The National Council of Teachers of Mathematics, *A Source Book of Mathematical Applications*. Bureau of Publications, Teachers College, Columbia University, New York, N. Y., 1943. Price $2.

Many practical applications from physics, shop and industry, engineering (including use of the slide rule), navigation, artillery fire, and the parallelogram of forces including the triangle of velocities should be introduced. In selecting the applications there is need to guard against choosing those in which the technicalities are too great. A selected bibliography of such material is given at the end of this report.

Modifications in content to permit of more careful teaching and of the introduction of practical applications are possible. If an attempt is made to cover too much material, pupils will not receive sufficient practice to secure reasonable mastery of the subject.

Suggestions for modification follow:

Algebra. Reduce the amount of time spent on special products and factoring, on complex fractions, on fractions with other than monomial denominators, on equations containing such fractions, and on complex work in radicals.

Increase the amount of time spent on fundamentals of arithmetic, numerical trigonometry, on the use of practical formulas in industry, aeronautics, and science, and in the solution of practical problems in those branches.

Plane Geometry. The objectives of a course in plane geometry should be to acquaint the pupil with geometric facts and their application, and to give him an appreciation of postulational thinking. It is not necessary to demonstrate all of the propositions in a deductive course. Some can be treated informally. By wise selection of theorems to be proved, time will be provided for the fundamentals of arithmetic and for continued use of algebra as well as for such practical problems as: "doubling the angle on the bow" and "bow and beam sailing," radius of action problems, the parallelogram of forces and the triangle of velocities, numerical trigonometry, the extension of locus to include the derivation of the equations for the circle, parabola, ellipse, and hyperbola, the law of sines and cosines, and the use of the transit and other instruments.

Plane Trigonometry. Omissions may be made in the development of trigonometric analysis including the proof of general trigonometric identities and the solution of trigonometric equations. Pupils definitely pointed toward higher mathematics will, however, need some work with equations and identities.

Solid Geometry. The proofs of formulas for surfaces and volumes can be treated informally. Deduction should be limited to the relations between lines and planes in space and to figures drawn on the sphere. Theorems about the intersection of two planes and all of those theorems about perpendicular lines and planes and parallel lines and planes are particularly important for an understanding of three-dimensional space. Relations of figures on a sphere lead directly to terrestrial geometry and should be emphasized. Small circles and great circles should be connected with circles of latitude and meridians of longitude on the earth's surface and with great-circle sailing.[3]

Time thus saved in both trigonometry and solid geometry can profitably be spent on improving skills in computation, on practical applications including the use of the slide rule, elements of navigation, or on mathematical analysis including topics from analytic geometry, the calculus, or advanced algebra. These topics, however, should not be introduced to the detriment of a clear understanding of elementary work.

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[3] It is interesting to note that this recommendation concerning solid geometry is supported by a recent statement of the College Entrance Examination Board with respect to its new Comprehensive Mathematics Test. "This examination will test the candidates' knowledge of algebra through progressions, plane geometry, trigonometry and logarithms, and intuitive [informal] and computational solid geometry. It is designed for students who wish to enter courses in engineering or other sciences, which have mathematics as a prerequisite. Candidates for this examination will normally have had four years of mathematics beyond the eighth grade."

Suggestions to Teachers

Teachers of mathematics whose academic and professional training has been adequate will need further training to carry out the recommendations in this report as follows:

1. Study of wartime and industrial applications of the fundamental ideas of mathematics
2. Further training in science in order to correlate mathematics properly with science
3. Refresher courses in colleges and universities when necessary

Teachers in other fields who will be inducted into the teaching of mathematics because of the emergency, and there may be a considerable number of them, should in every way seek to prepare themselves to do as acceptable work as possible. Those who have little or no knowledge of what they are to teach cannot expect to be successful. The main methods for improvement consist of:

1. Attendance at summer schools and in part-time courses especially planned to meet their needs. Such courses should include professionalized subject matter in the content material which they have to teach
2. Departmental meetings where problems of the emergency should be discussed (in the larger city school systems experienced teachers of the departments of mathematics should feel obligated to give as much help as possible to the less experienced ones)
3. Studying the content of elementary mathematics
4. Studying the best literature on the teaching of mathematics. A short selected bibliography is given which should be helpful to those who need it
5. The teacher of physics and chemistry will be able to suggest the types of formulas and equations used in applied science
6. In the larger school systems having vocational schools or departments, the instructors in trade and industrial education can be of a great deal of assistance to the inexperienced teacher by suggesting industrial applications of mathematics

Bibliography

The following bibliography is not intended to be exhaustive, but suggestive of practical applications that may be helpful to teachers of mathematics and science. It includes only the more elementary works. Some examples and some of the developmental material in many of these books are open to criticism, but thoughtful selection will yield a large amount of helpful material. For obvious reasons no attempt was made to list all of the useful textbooks.

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Fifty Typical Problems in Mathematics and Physics. Florida State Department of Education, Attention Paul Eddy, Editor, Talahassee, Florida. Price, 10¢.

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Practical Air Navigation. Civil Aeronautics Bulletin No. 24. Superintendent of Documents, Washington, D. C.

Seventeenth Yearbook of the National Council of Teachers of Mathematics. A Source Book of Mathematical Applications. Bureau of Publications, Teachers College, Columbia University, New York, N. Y. 1943. Price, $2.00.

Some Military Applications of Elementary Mathematics. Prepared by the Department of Mathematics, U. S. Military Academy, West Point, N. Y. The Institute of Military Studies, University of Chicago, 1942. Price, 15¢.

Suggested Unit Course in Blue Print Reading for Beginners in Machine Shop Practice. Also a Teacher's Manual and Answer Book for the same. The State Education Department of New York, Albany, N. Y. Price, 80¢.

Suggested Unit Course in Mathematics for Beginners in Machine Shop Practice. The State Education Department of New York, Albany, N. Y. Price, $1.35.

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Mathematical Education in War-Time

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For a number of years past, conventional academic subjects have been subjected to critical analysis both by general educators, and by subject matter specialists. Mathematics has received a great deal of such criticism. The more radical of its critics have denied the usefulness of some of its subject matter either in the whole or in part, and have proposed extreme changes in the school curriculum. These critics have been quite generally successful in having mathematical training removed as a required part of the educational program both in the college and the high school. The more friendly critics of mathematics have admitted that some of of its subject matter needs revision; that much of its teaching has been poor (though probably no worse than in other subject matter fields); that, in view of the fact that high school education now includes nearly the entire population of high school age, the required mathematics should be selected to fit the educational abilities of the pupils; that, in view of the fact that eighth grade pupils pass into high school without having achieved desired proficiency in arithmetic, courses must be provided to correct deficiencies in early education; and that emphasis must be given to such topics as scale drawing and graphical solutions of problems, which heretofore have not received adequate attention. This is certain: If an immediate program for war service, or a future sane program in general mathematical education is to be formulated, the mathematics teachers must do the job themselves and they must also force the initiation of the program.

Let us briefly review the status of mathematical education before the advent of this war. For the past twenty years several conflicting educational groups have been subjecting the entire curriculum to drastic changes. In this struggle, little by little, mathematics, once the pre-eminent subject of the curriculum, has been relegated to a minor and unimportant place in the curriculum of the high school. In many states of the union boys can graduate from high school without having studied one single hour of any mathematics. And many that do graduate with some mathematics have had a socialized or general course for only one year of study. In view of the fact that high school education has come to include the entire population of high school age, we readily admit that an adjustment must be made. But the guidance of our schools has been such that capable students have been advised against mathematics, or at the most advised to take only two years of mathematics. As a result, colleges were forced to lower their admission requirements from four years to three and finally to two years of high school mathematics. In many places, particularly in the West, one year and even no requirements in mathematics are now established conditions for entrance.

There have been several outstanding theories contributing to this calamitous situation. One of these is *Delayed Arithmetic.* The proponents of this theory would delay teaching formal arithmetic until pupils are more mature. Surely certain of the more difficult aspects of problems and solutions have been taught too early to many pupils; but to defer arithmetic to the fifth, sixth, or even seventh grade because it can be taught more easily there is begging the question. The arguments used for this could be used for the deferred teaching of all subjects. This same philosophy of delay has been suggested and in some cases put into practice in the high school, where the study of formal mathematics is deferred until the tenth year. This practice must be sharply criticized.

Incidental Learning in the teaching of arithmetic and higher mathematics, where a pupil would only learn facts as he met them in social situations, is an equally vicious principle when made a basic philosophy of education. In the high school the principle has its counterpart where an integrated program built around social situations would only teach the mathematics which is met in these situations.

Practical Courses are to be equally deplored. Such courses as shop mathematics, taught away from machines and tools to which they apply, mathematics for nurses, mathematics for home economics, mathematics for aviation trades, and mathematics for girls, fall in the same category. The implication is that the mathematics we teach in our regular courses is not functional, that it is so poorly taught that a shop course is necessary to show a boy how to apply common and decimal fractions to the selection of machine drills. It assumes that an entirely different course is necessary to teach a girl that if she cuts $\frac{3}{8}$ yd. of ribbon from $\frac{1}{2}$ yd. of ribbon, she will have $\frac{1}{8}$ yd. left.

The foundations of fundamental mathematics should be so well taught that the boy in the shop can apply them in the shop to the problems he meets there requiring the use of decimals, of angles and their sines and tangents, of geometric constructions, of ratios in gears and pulleys, and the making and reading of scale drawings with its easy extension to blue print reading. The fundamentals of mathematics should be so well taught that the girl in the sewing room, kitchen, or factory will be able to readily apply fractions and simple formulas to the problems she meets.

Another movement that has weakened the mathematics program is the introduction of an excessive amount of *Reasoning in Life Situations* into the subject of geometry. In many cases this has resulted in befuddled thinking and a lack of knowledge of plane geometry. Logic is not the sole right of mathematics; it should be the province of all high school subjects. The primary purposes of geometry are to teach the facts of space and the nature of mathematical thought.

Other educational theories which have contributed to the deterioration of mathematical education could be cited. But we as teachers of mathematics are in part to blame. Too frequently we have insisted that there is only one kind of mathematics, pure mathematics, and either a boy can learn it or he can not. We have forced many boys of average intelligence to be deprived of some mathematical education by such action. General mathematics has been one answer to this erroneous concept. It has taken the war however to show us how far short we have fallen in preparing boys for the mechanized, motorized, and scientific world in which we live. If we have not only the status of mathematical education at heart, but more essentially the true welfare of our children, and above all, the safety and preservation of our nation, we must take steps immediately to correct these erroneous trends in education.

One thing is evident. Many applications of mathematics are so technical and involved that to bring them into the realm of high school mathematics is prohibitive. Nevertheless, the fundamental courses in mathematics should certainly include, as motivation, those applications which are not too technical, both for boys and girls and provide many practical uses of mathematics. More important, the boy who is going on to study navigation, meterology, mapping, artillery fire, or other branches of the service, should be so well grounded in fundamental mathematics that he can immediately apply it as a ready tool in any of these branches.

In order to arrive at some basis for the immediate type of training we should give, let us examine some of the criticisms, suggestions, and requests made by the army, navy, and industry. First, we would call your attention to the widely publicized letter of Admiral Nimitz which appeared in The Mathematics Teacher of February, 1942. We wish to stress three startling facts in it.

1. A large per cent (62%) of the college freshmen applying for admission to the Navy failed to pass tests in arithmetic.
2. Only 23% of these freshmen had more than one and one-half years of mathematics in the high school and only 10% had studied trigonometry.
3. 75% of the failures in the study of navigation at the Navy Training School must be attributed to the lack of adequate knowledge of mathematics.

Notice that this letter does not ask the high school teachers to inaugurate special courses in navigation, avigation, and aeronautics, but requests that they make certain that *every boy* in high school takes mathematics of some type, and that every capable boy takes as much algebra, geometry, and trigonometry as his intellect permits; that mathematics be so well taught that it will function and can be used by the boy in special technical courses. These special technical courses will be provided by the government and taught by *specialists* qualified to teach them.

Second, we call your attention to a more recent letter from Randall Jacobs, Rear Admiral of the U. S. Navy and Chief of the Bureau of Navigation. We quote from this letter:

> . . . One of the greatest obstacles which the navy has encountered in its program to secure and train men for service in the navy has been the fact that high school and college applicants have not had the necessary instruction in certain essentials to permit them to be successfully trained in more technical fields. Lack of knowledge in the above essentials by trainees has hampered the navy training program tremendously. . . .
>
> The majority of secondary school graduates enter the colleges and universities of this country with only one and one-half years preparation in mathematics and the sciences and great numbers do not even have this fundamental background.

A suggested outline of study is appended to this letter in which is included plane trigonometry, solid geometry, quadratics, physics, shop mathematics and navigation, with the note:

> At least two and one half years of mathematics to include algebra, plane and solid geometry, and trigonometry should be given to all male students.

Again you will note that algebra, plane and solid geometry, and trigonometry are stressed as the fundamentals of mathematical training. Shop mathematics and navigation were also included but as we shall show later these topics can be included in the regular mathematics courses as motivation.

Third, we would direct your attention to the circular issued by the Navy, calling attention to the various types of service in which men are to be trained in the Navy and giving the fundamental prerequisite school training to qualify for such service. There are 26 services listed; all of them call for the prerequisite of mathematics of some type of another; all call for the use of complete arithmetic and elementary algebra. Of special importance is the fact that 23 services call for a prerequisite in plane geometry, 21 in trigonometry, 7 in solid geometry, and 2 in spherical trigonometry. Notice that there is no prerequisite in avigation, navigation, or aeronautics. The navy will take care of instruction in these latter branches.

Fourth, our efforts in immediate action can be guided by a release from the War Department, Headquarters Air Flying, Training Command, Washington, D. C., on the subject of academic pretraining for aviation cadets. This release is reprinted in the *American Mathematical Monthly* for April, 1942. It is a guide for a one or two year course for those present juniors and seniors in high school and college freshmen who have not had the regular mathematics. The mathematics of 6 semester units includes algebra (25 hours), plane trigonometry and logarithms, (40 hours), solid geometry (25 hours) and spherical trigonometry (10 hours). The emphasis in such a course can be gained by such quotations as:

> . . . primarily a course in the numerical aspects of trigonometry with only the amount of analytical trigonometry which is essential for the major purpose of the course . . . ; . . . substantial emphasis on slide-rule computation with each student possessing a cheap slide rule; stress on applications of all sorts, particularly those involving vector forces, velocities, and army and navy terminology. . . . Proofs should be held to a bare minimum; great emphasis should be placed on drawing of figures and the making of simple paper models for three dimensional situations.

You will notice the stress on the practical numerical side of mathematics. You will also note that algebra, geometry, and trigonometry are basic, and should be mastered as pretraining.

Fifth, we cite an appeal published in the *British Mathematical Gazette* of January, 1941. The article calls for volunteers to teach mathematics to "prospective members of air-craft crews." The mathematics to be taught is listed under eight topics, Note that all the topics are fundamental. elementary, non-technical, and straight mathematics.

1. Common fractions, problems.
2. Converting metric units into British units.
3. Averages; ratio and proportion; percentages.
4. The Pythagorean theorem; square root. (no proofs)
5. Transposition in equations.
6. Problems using simple equations.
7. Graphs, non-algebraic.
8. Triangles of velocities.

Sixth, we refer to an address made by Major L. Barrett, Ordnance Department, Second Corps Area, to Section I of the N. J. Association of Mathematics Teachers in December, 1941, on the subject "Mathematical Training as it Affects the War Program." A statement from this authority bears repetition. He said:

> A knowledge of mathematics is one of the foundations on which the operations of modern armies are based. It cannot take the place of study of tactics and strategy, but now that armies have been so thoroughly mechanized, it is impossible to visualize their successful operation unless the officers and men of which they are composed have a thorough groundwork in mathematical training.

Major Barret listed the elementary mathematics by topics, in order of importance, that must be mastered by the future selectees. They are:

1. A knowledge of trigonometric functions.
2. A knowledge of trigonometric tables.
3. The solution of the right triangle.
4. The solution of the scalene triangle.
5. The knowledge of how to construct a curve $y=f(x)$.
6. A knowledge of how to read curves.
7. A knowledge of graphic solutions. Intersection of loci.

8. A knowledge of reading verniers, slide rules.
9. The mil system of circular measure.
10. A knowledge of logarithms.

Seventh, in lighter vein, we quote from an editorial in *The New York Times*, It reads:

> So proficient are the Red battery commanders that they often hit the target without the gradual approach of range firing, and some of them are said to be such mathematical wizards that they calculate trajectories in their heads, without the use of rigid firing tables. Germans have long talked of the Russians' "Long-bearded-professor batteries."

While the authenticity of such firing may be in doubt, it points to the value of a long ago discarded process, that of mental arithmetic. It has been said that there is only 9 seconds elapsed time between sighting an attacking bomber and the release of the bomb. Surely speedy mental arithmetic is needed in antiaircraft fire. Similarly the artillery mil as an angular unit finds its greatest favor in that it is conducive to simple mental arithmetic with results within the limit of possible error. Likewise the Civil Aeronautics Authority Bulletin, No. 24, points out that a pilot who is his own navigator must be able to solve many problems without the use of pencil and paper. Thus he must be able to determine the approximate number of miles flown in a given number of minutes at a ground speed of so many miles per hour, as well as to estimate angles of drift and correction angles.

The quotations given thus far indicate the need for functional mathematics, so fully a part of the individual, that he can use it with skill and confidence. Several more quotations will show that the high school must be concerned with producing men with the necessary prerequisites cited above.

Eighth, in the March, 1942, issue of the *Journal of the National Educational Association*, we read:

> Since success in modern war requires complete and efficient use of the nation's total man power and since much of the effectiveness of the Selective Service System is determined by the decisions and the choices made by young men before they reach the age of twenty, the Commission recommends that educational agencies make a special effort to render advisory service to all young people, in school and out of school alike.
>
> In counseling youth with reference to continuing their education efforts should be made to conserve superior intellect and other abilities for national service in scientific research and leadership.
>
> Let our profession but answer boldly the call of the crisis and we shall fashion even out of the hard necessities of war, a school system more fit for the education of free men.

Ninth, the American Association for the Advancement of Science in their March, 1942, *Bulletin* give an indication of the tremendous job we are now facing. This article points out that for the air service alone, 150,000 men will be required this year and 300,000 more in 1943. The universities and colleges will be asked to supply half of these men or 225,000. For the necessary training, which could have been started in high school, this will mean 2,500 classes of thirty men each, a task that will strain the capacities of the colleges. About 300,000 men enter college each year in the United States. Half of these are ruled out of service by physical and other defects. Of the 150,000 left, a considerable number must be saved for scientific work and other services than aviation. The high school must step in and fill the breach by teaching the necessary prerequisite mathematics and physics to every boy capable of learning it.

Tenth, we call to your attention an article by E. U. Condon, Director (Associate), Westinghouse Research Laboratories, in the May issue of *Scientific American*, entitled, "We Need More Physicists." Dr. Condon says:

> Industry and science are being linked together by this war more closely than ever before During the present war new advances in applied physics are being made which have brought about an urgent demand for young men with sound scientific training. Any boy who has a real aptitude for scientific studies cannot serve his country better than by devoting his best efforts to learning as thoroughly as he can and as quickly as he can about mathematics, physics

and chemistry. He should not scorn the "Theoretical" fundamentals for hastily gained superficial "Practical" knowledge.

It is a great misfortune that many of our administrative officers of our public high schools have failed to appreciate the importance of sound training in fundamental mathematics and science. The quality of mathematical instruction in the high schools has sagged steadily in the past twenty years to such an extent that even the boy who gets an "A" grade in mathematics has a poor foundation on which to build his future work in science. No doubt the war will focus attention on this sorry state of affairs and reforms may result, but, in the meantime, boys who really want to help in this war should set themselves higher standards of mathematical attainment than most teachers demand.

Not only can the boy who has real aptitude for science find an opportunity to serve in the war, but with the steady advance in science-mindedness in all industry, it is safe to assume that the opportunities for scientific research in post-war industry will be much greater than ever before.

Last, a final word on this subject from the mathematics department of the United States Military Academy at West Point. In a specially prepared brochure on types of military problems involving only the use of elementary mathematics, prepared for high school teachers of mathematics, and reprinted by the Institute of Military Studies, University of Chicago, is the following significant statement:

> It is believed that effort will be more profitable if devoted to emphasizing the value of existing mathematics courses, rather than modifying them. All elementary mathematics is useful in the military services; it is desirable that this fact be widely known, so that the maximum number of students of proper aptitudes will take advantage of mathematics courses already offered. The importance of thoroughness and accuracy . . . should be stressed.

A brief comment about teaching aeronautics in the high school. No single authoritative war agency has requested it. Students need good solid mathematics and physics as a prerequisite to such study. The establishment of special courses in aeronautics in so many high schools that has recently taken place it appears to us is an excellent example of misdirected educational effort. We are specialists in mathematics and can teach it with confidence and surety. The army, navy, and technical schools have authorities to properly teach aeronautics if we supply them with students sufficiently grounded in mathematics and physics.

What then, as high school teachers, can we do? The teacher of mathematics anxious to serve his country and to prepare youth for positions in industry or war service, must realize first, that preparation in mathematics ranges from simple arithmetic to abstract theories of functions. It begins with a boy whose abilities in higher mathematics are non-existent, but who none the less must have thorough courses in general mathematics. He must have a confident use of simple arithmetic including common fractions, ratios, and decimals, of scale drawing, protractors, sine, cosine, and tangent functions in the solution of right triangles, and an ability to read graphs and tables.

The range of uses of mathematics spreads from this boy whose abilities are limited to general mathematics to the boy who can take all the mathematics offered him in high school, to the end that he may, after further work in college, become an officer in the army with an engineer's training, an officer in the navy, a meterologist, statistician, economist, or navigator.

A number of fundamental principles can be laid down.

1. In the war program, in this motorized age, every high school boy must study mathematics, either general mathematics or the conventional courses in college preparatory mathematics.

2. Every boy in the high school must take as much mathematics as he is capable of assimilating.

3. The mathematics the boy takes must be completely functional. That is the boy must so understand it that he can apply it with confidence and skill. It must be part of his nature, as natural in its use as his everyday speech. This definitely means better and more practical teaching so that mathematics will cease to be mechanical, meaningless drill.

4. The emergency does not mean that

boys should be urged to take courses in mathematics that they are not capable of understanding, but it does mean that more attention must be given to a guidance program which directs boys into courses in mathematics which they can take with success.

Too frequently in our high schools the adviser is a social problems man who is ignorant of the needs of mathematics in this emergency. He frequently over-exaggerates the difficulties of mathematics and many boys capable of doing mathematics well are driven away from it by unintelligent, biased advice. An adviser should be a general educator who is acquainted with various subject matter fields and appreciative of the needs for mathematically trained boys. This is true as much for the welfare of the boy as for patriotic reasons.

5. The emergency demands a greater effort on the part of all teachers of mathematics to so improve their teaching that:

   a. Pupils will understand every part of the mathematics taught. This means that algebra must be taught as a reasonable development of relations between numbers and variables; that geometry is postulational thinking applied to the discovery of relations about the space we live in.
   b. The more abstract materials can be given less stress at present and such materials selected as to make our mathematics functional and practical.
   c. Motivation must be provided through the war effort. This means that mathematics teachers have at least a fundamental understanding of elementary problems in avigation, navigation, artillery fire, and the uses of mathematics in shop work.

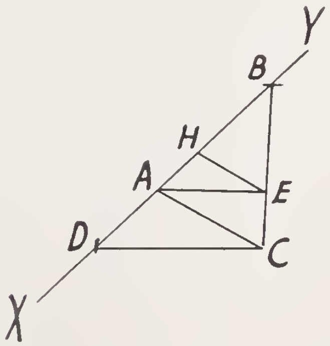
6. The emergency does not demand the introduction of special courses in high school or of innovations which would not be good mathematics under normal circumstances. It does demand that all capable students study four years of high school mathematics including trigonometry and solid geometry; that other less capable students take at least two years, and preferably three or four years of general mathematics which emphasize arithmetic, scale drawing, triangle of velocities, the ability to read graphs, charts, and tables, and the use of numerical trigonometry.

Several times there has been mentioned the advisability of providing material for motivation in the regular courses in mathematics related to the war program. The brochure reprinted by the Institute of Military Affairs, University of Chicago, contains many such examples. The alert teacher can find such examples with a little study of the existing literature. We shall illustrate what we mean by a simple example on radius of action. In the ninth grade, when studying distance-rate-time problems, this would offer excellent motivation. [*If the out-going speed of an airplane is O and its incoming speed is I, how far can the plane go before turning back to the same base if its gasoline supply will last h hours?*]

This simple problem can be solved by the formula

$$R=\frac{h(IO)}{I+O}$$

where R represents the radius of action. In actual flying the problem is solved by scale drawing as follows:



From A, the starting point the velocity is laid off as AC. The track to be patrolled is drawn through A as XAY. From C, with a radius equal to the air speed, arcs are described cutting the track at B and D. Through A draw AE parallel to DC, and at E draw EH parallel to AC. Then AH is the radius of action for 1 hr. AB the going out speed O, and AD, the incoming speed I. Thus in the above figure

$$AH = \frac{AD \cdot AB}{AD + AB}.$$

This relation might well occur in any plane geometry text as an original exercise under the topic of similar figures. The plane geometry student will certainly appreciate the value of geometry when he is shown this war- and peace-time application.

To summarize: The army, navy, industry, and scientific organizations indicate that the mathematics teachers can be of immediate aid in the war emergency by securing the following:

1. Every boy in high school should study mathematics according to his abilities, the more capable taking four years of mathematics including trigonometry and solid geometry.

2. Advisers must realize the acute need for mathematics and direct all capable boys into such courses.

3. It is not necessary to create new courses or to entirely reorganize the present courses in the war-time effort. I our objectives are valid, and our method of teaching will obtain these objectives all that is needed is an added emphasis or the practical.

4. Motivation can be provided through the use of simple formulas, scale drawing, and geometric theorems directly involved in military tactics. The teacher should know these applications.

5. Good teaching of straight mathematics by fully qualified teachers is what is needed. Such teaching is a far superior procedure than to attempt courses in aeronautics or navigation in the high school given either by teachers not fully qualified to teach them or taken by pupils who have not the necessary foundations for their successful study.

6. Modify your subject matter and your rate of teaching to attain complete understanding and you will best fit boys and girls for both peace-time and war-time uses of mathematics.

7. For the present juniors and seniors in high school who have not had the regular mathematics, give an abbreviated course immediately, similar to that suggested by the Army Aviation Corps.

(Reprinted from The Mathematics Teacher for October 1943)

Essential Mathematics for Minimum Army Needs[1]

THAT every enlisted man in the Army has vital need for mathematics is no longer open to question. This fact was strongly indicated in the statement of an earlier committee[2] on mathematics for inductees, whose report, to be treated more fully later on, was based upon analyses of a large sample of Army and Navy training manuals. The fact of essential mathematical needs has been even more certainly established by the present committee on mathematics, which, working with the cooperation of the Civilian Pre-Induction Training Branch of the Army Service Forces and the U. S. Office of Education, makes its report in this statement.

This committee consisted of: Virgil S. Mallory, Montclair (N. J.) State Teachers College, chairman; Rolland R. Smith, Public Schools, Springfield, Mass.; C. Louis Thiele, Public Schools, Detroit, Mich.; F. Lynwood Wren, George Peabody College for Teachers; for the Civilian Pre-Induction Training Branch, A. S. F. William A. Brownell, Duke University, consultant; and for the U. S. Office of Education John Lund and Giles M. Ruch.

BASIS OF PRESENT REPORT

The procedure employed by the present committee was to confer with Army officers directly in charge of training enlisted men and to observe the basic training process itself during the first thirteen weeks of the inductee's Army life. To systematize both interviews and observations, a check list of one hundred forty-one items was employed. This check list, carefully prepared by the committee, had the benefit of criticism from more than twenty Army training officers stationed in the Washington area. It was then tried out in the original and in a revised form with a dozen training officers in nearby camps. In its final form its contents provided the basis for informal conferences with another group of ninety-six training officers and for item-by-item checking by one hundred seventy-eight officers who were serving as instructors in basic training in seventy-four different kinds of Army jobs in Replacement Training Centers and unit training centers in eight States. The centers visited are operated by branches which together train seventy-five per cent of the enlisted men of the Army. The mathematics outlined later is that which is *actually needed* by nearly all men in their basic training.[3] Even the four per cent of illiterates in the Army are now being taught many of these topics in special classes. The purpose of the committee's investigation was to determine those items in mathematics which should make up the *minimum* equipment of the inductee. Every inductee might well have *more* than this minimum; but he *cannot have less* and meet successfully the demands of basic training.

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[1] This article may be reproduced in whole or in part without permission.

[2] This committee of the U. S. Office of Education which worked in conjunction with the Civilian Pre-Induction Training Branch, consisted of: Rolland R. Smith, chairman, Virgil S. Mallory, William D. Reeve, Giles M. Ruch, and Raleigh Schorling. The first two named, it will be noted, are members of the present committee. The report of this earlier committee will be found in: the April 1, 1943, issue of *Education for Victory*, the April, 1943, issue of the *Bulletin of Secondary-School Principals*, and in the March, 1943, issue of THE MATHEMATICS TEACHER.

So much for the first fact: the enlisted man has certain minimum mathematical needs. The second fact, equally important and equally certain, is that the typical inductee does not have the training in mathematics which he needs. An accumulating, if distressing, body of evidence supports this second statement. When only one inductee out of four can select the correct answer from four suggested answers for, 5 is 20% of what number?; when only one in three can select the correct answer for, $7-5\frac{3}{4}$; and when only one in four can select the correct answer for, $.32 \div .64$; under these conditions it is clear that the inductee is ill prepared to cope with the quantitative situations he will encounter in his basic training in the Army.[4] It could be argued that these mathematical deficiencies are not new, that indeed many adults and high school students have for years had limited proficiency in mathematics, and that the war has served only to highlight the evils of a long-standing condition. It could be argued further that, had Army inductees been taught their mathematics in the elementary school and in the junior high school as mathematics should be taught, the present situation would not be so critical, and the task of preparing inductees for Army service would be relatively easy. All these arguments can be conceded. At the same time, these arguments do not lessen, rather they enhance the urgency of doing something positive and of doing it immediately. As will be made amply clear, this task is not a simple one.

It is in this spirit that the committee reports its findings and its recommendations. The findings appear in the list of mathematical items beginning on page 247. The recommendations appear, partly in what follows at once, and more completely in the sections which follow the list of items. To look ahead a bit, these later recommendations have to do (1) with the improvement of instruction in mathematics, particularly in connection with the topics listed, and (2) with suggestions for setting up a program in the public schools and elsewhere.

NATURE OF THE ESSENTIAL MATHEMATICS

Before the list of mathematical topics is presented, it is well to state at once what this list *is* and what it *is not.*

(1) The list does *not* constitute a course in mathematics. Neither the Army nor this committee wishes to suggest a course of study to school officials and teachers. It is true that *some* kind of course, lasting if possible a full year or more, is needed to give young men about to enter the Army the basic mathematics which they will need. The responsibility for determining the nature and details of this course rests with local school authorities.

(2) To repeat what has already been said, the topics listed here represent a *minimum* of mathematical equipment for inductees. There is no thought that only the items listed should be taught, and that these should be taught only to the limits suggested. Nor is there any thought of asking capable students to substitute a course based on the listed items for the sequential mathematics of the senior high

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[3] It should be emphasized that many enlisted men go on for specialized training which calls for more mathematics than is outlined in this report. These men can profit by as much of the sequential work in mathematics as they can master.

[4] These data were furnished by the Personnel Research Section of the Classification and Replacement Branch of The Adjutant General's Office. The poor showing cannot be dismissed on the ground that these inductees had merely "forgotten" their mathematics because they had not "used" it for some years.

school. For those not taking such courses, instruction in the essential mathematics listed should be carried as far as time permits. And there are other mathematical concepts and skills, not found to be part of the necessary minimum equipment, but almost certainly valuable in the Army, on which instruction might well be offered.

(3) This report is an extension of the report of the earlier U. S. Office of Education Mathematics Committee. The present report *supplements* the first one by amplifying the suggestions offered for the *lower* levels of mathematics as represented in the Special One-Year Course.

(4) The topics are appropriate objectives of instruction for all young men about to enter the Army, regardless of whether they are in school or have left, and, if in school, regardless of the grade in which they may be found. For this reason the list should supply guidance for officials and teachers of special classes (night classes, extension courses) as well as for officials and teachers in the schools.

(5) It is a fallacy to assume that enrollment in advanced high school courses in mathematics assures proficiency in the minimum essentials listed in this report. Ample evidence in the Army and in civilian life shows that the study of algebra and geometry does not guarantee the maintenance of lower-order mathematical abilities and knowledge. On this account, school officials and teachers should take steps to see whether students taking advanced mathematics possess the needed minimum essentials and to teach whatever may be necessary. It should be noted in this connection that the earlier report already referred to suggested changes in the sequential courses to give time for much of the material of the present report.

(6) This report is not without significance for instruction in mathematics in the elementary school. To the extent that the proposed special program is made necessary for deficiencies in earlier learning, it will be made unnecessary as soon as instruction at lower points in the grades is improved. Teachers of the elementary grades are therefore urged to study carefully the recommendations in the section beginning on page 247.

(7) This report does not sacrifice general education to the particular needs of the Army. Every mathematical item in the list given can be justified in terms of general education.

(8) The casual reader of this report can easily oversimplify the educational problem with respect to the needed program of instruction. He will certainly do so if he disregards the evidence and assumes that *his* students possess the minimum mathematical essentials recommended. He will also certainly oversimplify the problem if he thinks of the essentials listed purely in terms of mechanical, paper-and-pencil computation. Proficiency in computation is of course necessary, but it should not be mere mechanical proficiency. Much more than computational competence is called for.

On this last point the testimony of training officers is unequivocal. They say that many enlisted men, even those who seem to be able to obtain correct answers in abstract computation, are unable to *think* quantitatively. That is to say, they cannot use in practical situations even the limited skills which they possess.

The implications of this charge (and it was universal) are unmistakable, and they cannot be disregarded. What is needed is a reorientation, a change of emphasis, in instruction. Computation has too often been stressed, and accurate, skilled thinking in concrete quantitative situations has been minimized. Many students have acquired tricks with numbers which have proven valueless under conditions of use. Meanwhile two aspects of mathematical learning have suffered, namely, (a) understanding and (b) experience in application. An inductee *understands* when he has acquired the meanings which give system, order, and logic to mathematics,—when, for example, he knows the functions of the fundamental operations and knows when to use them and why they affect numbers as they do. He has had the requisite *experience in application* when his learning has included many occasions in which he has successfully put to use his mathematical training in situations which are significant to him.

It is hoped that this report may help to establish correct balance among the various aspects of instruction; and it is for this reason that half the space in this statement has been reserved for suggestions respecting instruction on the listed mathematical essentials.

(9) It follows from all that has been said that refresher courses in the high school and elsewhere are not the sole remedy for the present emergency. Such courses may only restore former skills which are inadequate for Army needs and for the demands of civilian life. Instead, young men about to enter the Army must be taught something which heretofore has not often enough been taught, namely, the ability to meet quantitative problems effectively, confidently, and sensibly. They must be able (a) to identify the quantitative aspects of the situations which confront them, (b) to deal with these situations by approximation and estimation when computation is not required, (c) to recognize and use the simpler symbolism of mathematics, (d) to tell when and how mathematical symbolism, concepts, and processes are to be employed, and (e) to compute accurately, quickly, and intelligently when computation is called for. Courses with objectives less ambitious than these are of limited value.

Findings with Respect to Mathematical Needs

Some explanation is required for the check list which was used by members of the committee in their visits to Army camps. The items dealt with mathematical skills, concepts, and relationships as well as with memorized formulas and rules; they covered the fields of arithmetic, and the simpler aspects of algebra, geometry, and trigonometry. With many of the items an example was given to set a working level of difficulty. Only the uses of mathematics in the thirteen weeks of basic training given to all inductees were to be recorded. The needs of candidates for officer training, and of specialists whose requirements in mathematics might be considerably more than those outlined in the check list, were not included in the investigation.

A total of one hundred seventy-eight instructors actually engaged in teaching inductees filled out the check list. They were asked to do four things: (1) to mark each item as of *frequent, occasional,* or *rare* use; (2) to classify the examples given as of *less,* the *same,* or *greater* difficulty than inductees would actually need; (3) to furnish practical examples of how the mathematical items listed are used; and (4) to report on mathematical needs not covered in the list. Each instructor was advised before marking the check list to be concerned only with the mathematical needs in his own particular field of instruction, not with his philosophy about needs in general.

The results of the marking of the check list are summarized, examples are given of those practical uses which are not too technical, and the limits of difficulty for most items are stated in the outline which follows. It will be seen that, in general, these limits are expressed in terms of competencies to perform certain tasks. This is one reason why the resulting outline of mathematical needs cannot be considered a course of study.

In selecting from the items on the check list those which should be included in the content of essential mathematics, attention was given first of all to frequency of use. On this basis a number of the items had obviously to be rejected. They occurred so seldom that, it was felt, instruction on them might properly be left to the Army branches concerned.

But it soon became apparent that frequency of use alone was not a sufficient basis for rejecting or including an item. In many cases, an item which was indicated as rarely used might still be of fundamental importance and necessary. For example, an inductee assigned to the Engineer Corps might not, for a considerable period, have to aid in constructing a bridge. But when he did, he should know how to construct, on the shore, a perpendicular to the line of the bridge. Again a supply clerk may spend most of his time issuing supplies. But at regular intervals he must do paper work that may involve adding rather long columns of figures, multiplying and dividing with decimals, and using fractions and per cents. While this part of his work is done only rarely or occasionally, he cannot be a good supply clerk unless he is proficient in these uses of mathematics. In cases of this kind, items were retained because of their crucial value in spite of the relative infrequency of their use.

OUTLINE OF ESSENTIAL MATHEMATICS FOR MINIMUM ARMY NEEDS

A. Reading and Writing Arithmetical Symbols

1. Whole numbers (to six digits).
   Serial numbers on identification tags and rifles contain as many as eight digits.
   Used in reading stock lists, equipment numbers, speedometer mileage, radio frequencies, blueprints.
2. Common fractions (denominators of powers of 2 through 64; 3, 5, 6, 10, and 12).
   Fractions with denominators in the ten-thousands are frequently used in map reading.
   Used in indicating parts of an hour, a mile; sizes of wrenches, bolts, nuts, drills; reading the carpenter's square.
3. Decimal fractions (to three places).
   In machine work it is sometimes necessary to read micrometer calipers to ten-thousandths.
   Used in indicating specific gravity of batteries; setting up correct frequencies in kilocycles; expressing caliber of projectiles; measuring spark plug gaps, valve clearances.
4. Per cents (to 100%).
   In certain instances per cents less than 1% are used to indicate composition of metals and the proportions of chemicals in solutions.
   The fractional equivalents of the dozen or so commoner per cents should be memorized.
   Used in indicating per cent of men assigned to details, apportionment of pay, proportions of ingredients in mixtures such as insecticides.

B. Counting

5. Counting by 1's, 2's, 5's, and 10's (to 500).
   Used in counting off in the squad and in infantry drill; counting automotive units; pacing for determining distances; cranking heavy tank engines; counting number of men for mess.

C. Operations with Whole Numbers

6. Addition (columns of not more than five addends of three digits each, and shorter columns of not more than six digits).
   Stock, mess, and supply clerks need to add much longer columns and to add short columns of numbers of more than six digits.
   Used in determining daily mileage for reports, amount of ammunition and materials consumed, total circuit resistance, total number of men.
7. Subtraction (numbers of not more than six digits).
   Used in reading map grids; determining directions; computing distances; determining the age of parachutes and pneumatic equipment in order to check their safety.
8. Multiplication (numbers of four digits by numbers of two digits).
   Calculation of total amount of rations, ammunition, and company supplies involves larger numbers.
   Used in finding distances when time and rate are given; keeping personal budgets; figuring costs; substituting in orientation formulas.
9. Division (numbers of four digits divided by numbers of two digits).
   Division of numbers of six digits is used in dealing with radio frequencies; reduction of map scales; estimation of quantities of materials in concrete construction.
   Used in determining direction and ele-

vation of sight; rationing of supplies and ammunition; changing units of measure as from inches to feet.

D. Operations with Common Fractions (Denominators limited as in 2 above)

10. Addition.
Used in determining over-all dimensions from blueprints; computing total demolition charges; calculating seam allowances.
11. Subtraction.
Used in blueprint reading; finding tap and die sizes; calculating depth of cut in machine work.
12. Multiplication.
Used in determining amounts of ingredients in mixtures; finding weight of castings; calculating total weight of rivets for repairs.
13. Division.
Used in solving electrical problems involving Ohm's Law; calculating tubing lay-outs; making switchboard installations.

E. Operations with Decimal Fractions (Denominators limited as in 3 above)

14. Addition.
Used in finding total money value of rations (to thousandths of a cent); adding currents in legs of circuits.
15. Subtraction.
Used in determining mileage from speedometer readings; checking aircraft specifications; machine shop work.
16. Multiplication.
Used in finding correct frequencies in electrical work; windage determination.
17. Division.
Used in making switchboard adjustments; determining costs; laying out rivet patterns.

F. Part-Whole Relationships, with common fractions, decimal fractions, and per cents

18. Finding part of a quantity.
Used in making pay deductions; determining amounts to be mixed in insecticides, in cooking, in mixing concrete; computing dial settings; finding part of supplies to be drawn; determining number of parachutes to be kept packed in accordance with a fixed percentage.
19. Finding what part one number is of another.
Used in finding speeds when different-sized pulleys or gears are used, outputs of transformers; determining slopes in setting grade stakes, the portion of a company that qualify in marksmanship.
20. Finding a number, given a part and its relative size.
Used in calculating amount of product in Army baking operations.

G. Ratio and Proportion

21. Understanding basic idea.
Used in statements of concrete mixtures, relative speeds and feeds, fuel mixtures.
22. Solving problems.
Used in finding scales in aerial photographs; calculating speeds when different sizes of pulleys or gears are used; figuring slopes.

H. Powers and Roots

23. Finding powers (squares and cubes).
Used in solving formulas.
24. Finding squares and square roots from tables.
Used in calculating sides of right triangles and diagonals of rectangles.

I. Graphs and Maps

25. Understanding grids and scales.
Knowledge of the fact that the numerator of a representative fraction (R.F.) is a distance on the map and that the denominator is the distance on the ground is necessary in map reading.
Such scales as 1/20,000, 1/62,500, and 1 inch = 1 mile are commonly found on military maps.
26. Determining directions from a map.
Used in determining direction of travel to reach an objective; orienting one's own position; determining direction in heavy gun fire.
27. Interpreting maps and graphs.
Used in discovering the location of artillery, the command post, hostile forces; determining the height of points on a terrain (from a map showing contour lines); scouting and reconnaissance; radio and signal communication.
28. Making graphs and maps.
The enlisted man is not commonly required to make maps and graphs, ex-

cept for rough sketches, but experience in making them is essential to proper understanding.

J. Tables

29. Reading from tables.
Reading to the nearest tabulated figure is all that is usually required.
Used in finding the angle of elevation for an artillery piece from firing tables; making corrections for windage; determining type of ammunition; finding strength of materials, fractional equivalents; converting measurements.

K. Formulas and Equations

30. Understanding of simple symbolism of algebra, such as a, K, a^2, b^3, $\sqrt{a}$, a_2, π.
Used in practically all branches of the armed services.
31. Simple formulas to be memorized: area of circle, triangle, rectangle; volume of cylinder, rectangular solid; distance, rate, and time.
Less used are the formulas for area of a parallelogram and of a trapezoid, and for conversion of temperature readings between Fahrenheit and Centigrade.
32. Substitution in simple formulas.
Used in such formulas as those listed in 31 and others as:
$N = \frac{3}{4} A$ (demolition of a steel beam);
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ (total resistance of three conductors in parallel).
Besides these simple formulas others of a greater degree of complexity are widely used in some branches of the service. For example, the demolition formula:
$N = R^3KC$ plus a per cent of N depending upon the size of N.
33. Solution of simple equations, such as:

$$3n = 6 \qquad 2n - 3 = 7$$
$$n + 3 = 6 \qquad 2n + 3 = 7$$
$$n - 3 = 6$$
$$\frac{n}{3} = 6$$

These equations usually result from substitutions in formulas.

L. Positive and Negative Numbers

34. Symbolism and meaning.
Used in indicating direction of flow of both alternating and direct current; machine gun firing tables; angle of sight instruments; calculating data for range cards on machine guns; determining direction; designating storage battery terminals.

M. Measurement, including understanding of basic units

35. Length, weight, area, and volume.
In many branches there is necessity for performing the fundamental operations with denominate numbers.
Used in determining area of fire, storage tank capacity, firing tensions, load limits; placing poles in field wire communications.
36. Temperature (C and F), angles (degrees, minutes, and seconds), time (24-hour clock).
Temperature measurement is used in determining tension for a wire, condition of engines, condition of patients; angles are used in machine shop work, machine gun and mortar firing, map reading; determining the number of degrees of revolution of a rotating shaft. The Army uses the 24-hour clock.
37. Metric system with simple equivalents.
Used in medical measurements; radio repair; designating gun caliber, dispensary supplies.
38. Measuring instruments.
Compass is used in determining directions; tape and rule are used in measuring lengths; protractor and compass are used in map reading; transit is used in road building and communications construction; calipers and dividers are used in the machine shop; steel square and level are used in carpentry; scales are used in measurement of weight.
39. Limits of accuracy or tolerances.
These range from the precise measurements in the machine shop, through the tolerances found in adjusting weapons, to the fairly rough estimates of road overhead clearances.
Used in measuring spark plug and breaker point gaps.
40. Estimation.
Load that a bridge will bear, weight of a load on a truck, number of men in a group, height of aircraft, distance in scouting, range for firing, distance marched, speed of vehicles.

N. Geometric Concepts

41. Point; straight, curved, horizontal, vertical, oblique, parallel, and perpendicular lines; angle; and slope.
    Used in technique of fire; simple mechanical drawing and blueprint reading; map reading; setting the grade of a road.
42. Triangle (right, scalene, isosceles, and equilateral), parallelogram (square and rectangle), trapezoid, circle, ellipse, and regular polygon; prism, cylinder, cone, and sphere.
    Used in cone of fire; aiming circle; machine cams; cylindrical drums; optical instruments; construction.
43. Similarity.
    Used in relationships among automotive parts; pattern making; recognition of airplanes in flight.

O. Drawing and Construction

44. Use of ruler graduated in 32ds and in 10ths of an inch, and in millimeters; of compasses to construct circles; of protractors to measure and to draw angles.
    Used in preparation of parts for welding; radio repair; pattern making; laying out range charts; determining azimuths.
45. Construction of a perpendicular to a line.
    Used in construction of bridges; machine shop work; the thrust-line system of establishing a rendezvous; blueprint reading.
46. Understanding of views of a simple object as given in a scale drawing, blueprint, or sketch.
    Used in fabrication of materials; motor mechanics; functioning of rifle; troop tactics; blueprint reading.
47. Knowledge of the 3-4-5 relation of the sides of a right triangle.
    Used in carpentry; sighting mortars.

P. Miscellaneous

48. Averages: mean, median, and mode.
    Used in calculation of average rations, average marksmanship scores; constructing a pace scale; Medical Corps statistics.
49. Rounding numbers.
    Used in a very great variety of calculations.

General Suggestions with Respect to Instruction

Point of View

The Army needs enlisted men who have practical abilities in mathematics. So do the affairs of civil life. Moreover, the levels of mathematical ability which meet *minimum* Army needs for its enlisted men are relatively simple—essentially elementary school arithmetic and the less complicated concepts and skills of algebra and geometry. These facts emerged time and time again from interviews with training officers and from the check lists. If these facts have been stated more than once before in this report, they are repeated because they need to be repeated.

The public schools have not always developed the kinds of practical mathematical ability which are desirable both in the Army and in civil life. Instead, the mathematics period has too often been devoted to the development of skill in abstract computation. As a result the Army finds that many enlisted men who have had considerable work in mathematics are virtually helpless in practical quantitative situations. For example, men who in the geometry class may have skillfully used the Pythagorean Theorem fail to see its applicability and value in erecting the corner studs of barracks.

Almost all inductees will have had several years of school arithmetic. Hence, the needed course in mathematics will be in part remedial in character. But this fact is by no means an unmixed blessing, for among the consequences of traditional courses may be attitudes of indifference and even of hostility, misunderstandings, faulty habits, and ineffective procedures, all of which must be overcome before material progress of a positive kind can be undertaken. Furthermore, the instructional task is made more, rather than less, exacting by reason of the fact that the content must be *useful.* The truth of the statement and its implications for instruction may not be evident at first glance.

Points of Emphasis

Remedial instruction.

Responsibility for remedial instruction in arithmetic lies with the teacher of secondary mathematics. The same responsibility, as a matter of fact, has always lain with the teacher of secondary mathematics, though he has not been inclined to accept it. He may have acted on the assumption that no such remedial instruction is necessary; or on the assumption that, if it is necessary, it should be someone else's job; or on the assumption that if his students, with or without arithmetical competence, can be successful in the sequential mathematics courses, his obligation is met. The present emergency invalidates all these assumptions, as indeed they would long since have been invalidated if we had but evaluated sensibly the consequences of arithmetical illiteracy in personal and social terms. Be that as it may, intelligent mastery of arithmetic is now recognized for its importance, and to the extent that it is not in the possession of pre-inductees, they must be aided to acquire it.

The usual program of remedial instruction, which is merely to assign more practice of the previously ineffective types, must be abandoned; it does not meet the need. The teacher of secondary mathematics must be genuinely anxious to diagnose arithmetical deficiency (and mathematical deficiency in general) as the first step. If the student cannot correctly add columns of two- and three-digit numbers, the teacher needs to know why. Perhaps the student has never learned to add, relying upon simple counting to satisfy his needs; or, perhaps he is deficient in addition merely because he does not know the addition facts as well as he should. If the student adds $\frac{1}{2}$ and $\frac{1}{4}$ and gets $\frac{2}{6}$, again the teacher needs to know why before undertaking remedial instruction. Perhaps the student fails utterly to understand fractional values; or, perhaps he understands such values but does not use them in computation, substituting purely mechanical procedures. It should be obvious that the particular form which remedial treatment will take is directly dependent upon the type of deficiency which is to be corrected.

New Concepts.

But the course in essential mathematics should include more than remedial work, whether arithmetical or otherwise. It should include the development of new concepts (or concepts so incompletely developed in the past that the adjective "new" is warranted) and the provision of many and varied experiences in applying what is learned.

Procedures for teaching new concepts may be illustrated by using here a single example, namely, the development of concepts of units of number. This one illustration will serve because the course of learning concepts in this area is truly typical of concept development in mathematical areas generally.

The learner's beginnings with units of number are concrete. The smaller numbers first take on meaning because they are represented by groups of objects which can be readily counted and otherwise manipulated. Continued experience, particularly if that experience be with different objects, different groupings, and for different purposes, eventually frees the concepts of the smaller numbers from their dependence upon particular details and makes the freed concepts available for relatively abstract thinking.

But direct sense experience has its limitations when it comes to learning the meaning of larger numbers. We commonly count to determine the precise number of perhaps twenty-five or fewer objects, but rarely do so to determine a number of a hundred or a thousand objects, to say nothing of ten thousand, a hundred thousand, or a million. To have any understanding of these large numbers we must utilize something other than direct sense experience.

That "something" is available in the smaller groups of number which have already been acquired, such as groups of 2, 5, and 10. Knowing that 25 is five 5's, that 42 is six 7's, and that 72 is eight 9's, we can understand 25, 42, and 72 without the necessity always of assembling piles of objects and laboriously counting to find totals. The smaller groups thus serve to carry us beyond the limits of direct experience, but they could not do so, were they not themselves based upon direct experience to give them meaning.

Since our number system is decimal in character, the multiples of 10 naturally enter into an understanding of larger numbers with values far beyond those sensed by the average person. For example, the number 8543 may be thought of as 85 hundreds, 4 tens, and 3 ones; and this reconstruction of the number makes it sensible to whoever really understands a hundred even though he cannot comprehend a thousand. Or, the same number may be thought of as 8 thousands (with 10 hundreds in each thousand), plus 5 hundreds, and 43. And as the individual gains further number knowledge, even larger numbers take on new meanings. For example, he may think of 751,823 as about $\frac{3}{4}$ of a million; of a million, as about 1000 thousand. None of us has experienced a million directly and concretely; but all of us, by making use of multiples of smaller units, understand something of the meaning of a million, an abstraction which is far removed from direct sense experience.

The foregoing paragraphs on units of numbers then, illustrate the complexity of the instructional task involved in developing mathematical sense,—they illustrate its complexity and at the same time suggest the general pattern which instruction must take in order to achieve the goal set. The movement is from concrete (where the meaning is most easily apprehended) to the abstract (where the idea or skill is freed of its particularized content) and back again to the concrete (where the freed idea and skill can be applied usefully). To the extent possible within limited space this movement will be apparent in the sections which follow, where suggestions are offered for teaching the minimum mathematical topics.

Applications.

In this section two special responsibilities in the teaching of essential mathematics have been discussed: (1) the teacher must provide for remedial instruction based upon real diagnosis of shortcomings in previously taught skills, and (2) he must undertake to develop new mathematical concepts. He has still another task: (3) he must provide ample experiences in application. From the standpoint of learning, this third task completes the cycle which has just been mentioned, from concrete to abstract and back again to concrete. "Back again to concrete" means use in practical situations. It is not uncommon to use concrete visual and other sensory aids to derive the formula for the area of a circle by dividing circles into equal sectors. This procedure, which is wholly admirable, serves to develop the abstract idea from concrete experience. It is less common in instruction, however, to take the next step and have students apply their abstract knowledge to new concrete (practical) situations. In the example here under discussion, it is less common to have students actually determine the area of the base of a cylinder, preliminary to determining its volume, by measuring a cylinder directly to ascertain the elements for the mathematical formula. Yet, without this experience in application, knowledge of the formula cannot guarantee ability to *use* the formula as it is used in Army and civilian life.

Again, it is not uncommon to develop the concept of a mile by stating that it is a distance equivalent to 5280 feet (feet being objects of direct sensory experience) and to 1760 yards (yards also being experienced rather directly). Yet the term mile can have but little meaning if taught only in this way; after all, 5280 feet are a great many feet, and 1760 yards are a great many yards. Somewhere in the teaching procedure the abstract concept of mile needs to be checked against direct experience: the student needs to pace a mile, timing himself, and counting the number of paces required. He needs also to identify the distance of a mile as that between such-and-such familiar objects. In the absence of such experiences the concept mile can scarcely function valuably in practical situations.

The purpose of the preceding several paragraphs has been to suggest ways of developing *mathematical sense.* Mathematical sense is what the Army requires, and it is what civilian life also requires for more effective adjustment to the quantitative aspects of our culture. More and more, methods of instruction must tend toward laboratory procedures. Such teaching procedures provide the direct first-hand experiences that will insure that concepts and skills will function in practical situations.

Importance of meaning.

Teachers who are not accustomed to thinking about mathematical instruction in terms of meanings may raise one or more of several questions as they continue through the report. They may ask: (1) "But I thought what is wanted is a practical course, and everywhere I encounter theory. How can my course be practical if I teach all this theory?", or (2) "Where are the proposed meanings to be taught—in the lower grades, or in the junior and senior high school, or at both levels?", or (3) "Granted that these meanings are important, can they be taught even in high school to students who are only average or sub-average in ability?", or (4) "Must I try to teach these meanings even if it means neglect of some degree of computational skill, or should I insure computational skill first, giving such time as remains to meanings?"

These questions are all pertinent, and they deserve answers even though the answers must be brief and somewhat dogmatic. (1) One does not have to become theoretical when one discusses meanings; meanings are really practical. It has long been pointed out that skills cannot be used intelligently if they are not learned intelligently. Meanings function practically in intelligent use. We can prepare the student for particular jobs without bothering much about meanings; but the student so prepared is helpless when the job is changed. It is meanings that are transferred, and it is this transfer that is essential if the student is to be adequately equipped to face new situations. (2) The proposed meanings should be taught wherever needed for intelligent learning. They should certainly be taught in the lower grades when concepts and skills are first introduced, and experience has shown that they *can* be taught at this time. But if these meanings have not been acquired in the lower grades, they become an essential part of mathematics courses in the junior and senior high school. (3) It has not yet been demonstrated that average and somewhat sub-average students cannot acquire the meanings discussed in this report. Certainly past experience in this respect is an unsafe guide, for in the past, effort expended in this direction has not always been continuous and expert. Still, realism requires us to face the fact that some students may be incapable of mastering the proposed meanings. In such cases, and they should be relatively few, it is probably best to concentrate on computational skill. (4) Nothing in this report should be interpreted as suggesting lack of concern for computational skill. If the report seems to over-stress meanings and understanding, it is only because these mathematical objectives have been too long under-stressed.

Extent of Treatment

To treat adequately all the changes in instruction which would follow from what has been said would require a textbook, or even several textbooks. No such amount of space is available in this report. It is possible here only to sample the suggestions which might well be offered for the improvement of instruction. Yet, the necessarily brief and incomplete discussions of the selected suggestions are offered with the firm conviction that, if heeded, the recommendations with regard to teaching procedures will move instruction considerably closer to the goal. The careful reader of this report will scarcely be able to miss the general tenor and purpose of the suggestions, and the alert teacher will catch the implications for instruction which cannot be treated here.

Sources of Instructional Material

Those responsible for the establishment of courses in mathematics which will cover the minimum essentials outlined in the preceding section will be concerned with the possibility of securing suitable instructional material. It will be found that many of the textbooks in general mathematics made for use in the junior and senior high school will approximately cover the essentials listed previously. To be satisfactory for the intended course the text should have a treatment of arithmetic (operations with whole numbers, fractions, decimals, and per cents). It should include graphs and scale drawing leading to work with maps and blue print reading; literal numbers leading to simple formulas and equations; signed numbers; geometric concepts, drawings, and constructions; keeping simple accounts; and measurement. It should emphasize the practical applications of mathematics. It may also contain the uses of the sine, cosine, and tangent, and possibly measures of central tendency. When the available text does not include all of the essentials outlined above, supplementary material can be provided by the teacher. In any case, whatever text is used, the teacher should see that the problem material is made real and practical. For this reason the teacher should collect such material.

Specific Suggestions with Respect to Instruction

A. Reading and Writing Arithmetical Symbols (Items 1–4)

This topic may seem to be rather elementary for pre-inductees. It would be, if only the ability to read and write abstract symbols without knowledge of their logical structure and interrelations were the goal. The purpose, however, in teaching students to read and write whole numbers, common and decimal fractions, and per cents is to raise their understanding of these symbols to a more functional level. Instruction is needed which shows the logical basis of such symbols and those relations which make for rich number concepts.

Whole numbers.

Number denotes quantity by a measuring off into so many units. Although 10 and powers of 10 constitute the basic units upon which number is built, they are not the only units which enter into the comprehension of number. Let the reader test himself by reading the following numbers: 144, 325, and 81. As he reads these numbers, units of 12, of 5 or 25, and of 9, and possibly others in addition to units of 10 and powers of 10 occur to him. Probably no two individuals would measure all the amounts mentioned above by the same set of basic units. However, when numbers of two or more digits are read, units of 10 and powers of 10 play an increasingly important part. A number such as 43,642 may suggest 40,000 which in turn is subject to further interpretation. Many opportunities present themselves in traditional courses in mathematics to enrich thus the student's concept of number.

Throughout this report emphasis is placed upon the importance of place value (inherent in our number system) in the comprehension and manipulation of numbers. Traditionally, place value has been taught by rote methods, and students memorize merely the names of place

alues. Charts showing place values ap-
ear in most texts. Without accompanying
nstruction to make place value meaning-
ul, these charts make little contribution
o understanding. Since place value de-
ends upon powers of 10, the need for ex-
ensive experience with these units is ob-
ious, experience which reveals decimal
elationships in ascending and descending
rders, so that 1000 is known as 10 hun-
reds, 10,000 as 100 hundreds, 1 million as
000 thousands, etc., and similarly, so that
00 is known as 1/10 of 1000, 1000 as
/1000 of a million, 10 as 1/100 of 1000,
nd the like.

ommon fractions.

Students' difficulties with common frac-
ions stem from two sources: failure to
nderstand the ideas which fractions ex-
ress and failure to see these meanings in
ne form of fractional notation. For exam-
le, students may not understand $\frac{3}{4}$ as an
xpression of ratio because they are ig-
orant of the concept of ratio or because
ney are unable to see that $\frac{3}{4}$ *is* an expres-
on of a ratio.

We use fractions to show: (1) a part or
arts of a whole or of a group, (2) indi-
ated division, and (3) ratio. There are
ifferences enough among these meanings
nd uses to demand the attention of the
eacher.

(1) The phrase "$\frac{3}{4}$ of an orange" means
nat a single orange has been divided into
our equal parts and that three of these
arts are under consideration. The de-
ominator, 4, tells the relative size of the
arts; the numerator, 3, the number of
arts being considered.

Fractions as applied to single objects
ccasion little trouble for students, but
ne corresponding application to groups of
bjects ($\frac{3}{4}$ of 12 oranges) and to abstract
umbers ($\frac{3}{4}$ of 12) is not so readily grasped.
et the extension does not seem to be very
reat. Students who fail to make the ex-
ension have in all probability been hurried
nd have responded in the only way that
open to them, by superficial learning.

The nature of appropriate instructional procedures should be clear by now to the reader of this report: Start with concrete experiences, and continue at this level as long as may be necessary to engender the needed meanings. Let the student use real or representative objects to find answers for as many examples as necessary of the type: $\frac{2}{5}$ of 10 books, $\frac{3}{8}$ of 16 sheets of paper, $\frac{3}{4}$ of 12 erasers, $\frac{2}{7}$ of 21 pencils. At this stage of learning, answers should be found by placing objects in groups or by indicating the division by drawing lines around representative objects. The example may then be written in abstract form, together with the answer, and the functions of denominator and numerator made clear by referring both to the fraction and to the operation completed with objects. The transition to purely abstract numbers and computation comes later. At first it is wise to check abstract computation by returning to concrete situations. When real understanding has been achieved, practice needs to be assigned to promote proficiency and to fix the new computational habits.[5]

(2) The fraction $\frac{3}{4}$ may be considered an indication of a division. Here the major instructional task is to teach the significance of the form of notation: the line between numerator and denominator means a division. In Army usage this meaning of fractions occurs chiefly in formulas and in finding per cents for fractions or fractions for per cents. These uses are common enough and important enough to require that this meaning of fractions be thoroughly understood.

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[5] When these meanings are first taught in the lower grades, many class hours will be needed. When they are reviewed or retaught in later grades, much less time may be necessary. In the senior high school it is possible that a few minutes will suffice. However, even in the senior high school the teacher should begin in this simple concrete way and should not pass to the abstract phase until it is clear that the concrete phase has been mastered. *The caution in the last sentence applies generally to all aspects of instruction in essential mathematics.*

(3) The fraction $\frac{3}{4}$ may be considered the ratio three out of four. This meaning is important enough in the Army and in civilian life to require careful instruction. The first task for the teacher is to develop the idea of ratio, and this topic is discussed later in Section G. The next task is to relate the meaning of ratio to the fractional form of notation. Difficulties are more likely to arise in teaching the first than in teaching the second aspect of this use of fractions.

Part of the problem of teaching the meaning of fractions is to establish the relationships between equivalent fractions, relationships which are essential if later on the student is to reduce fractions and to find common denominators with any degree of intelligence. Again, the start should be made with concrete materials, in order that the relationships may be readily apparent. With such materials the student should experience little difficulty in seeing that the following series (and others like them) are true:

(1) $1=\frac{2}{2}=\frac{4}{4}=\frac{8}{8}=\frac{16}{16}$

(2) $\frac{2}{3}=\frac{4}{6}=\frac{8}{12}=\frac{16}{24}$

(3) $1=\frac{2}{2}=\frac{3}{3}=\frac{4}{4}=\frac{5}{5}$

(4) $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{4}{8}=\frac{5}{10}$

If such relationships are taught without reference to concrete objects, the price may be knowledge which will not function when needed.

Decimal fractions.

Decimal fractions are related to common fractions for their meaning and to whole numbers for their notation. Failure to grasp either of these basic relationships or the reciprocal relationship between them leads to misunderstanding of decimal fractions and to inability to deal with them in a sensible and effective manner.

It is common practice to have the student derive decimal fractions directly from equivalent common fractions without preliminary experience in measuring with decimal units; units of 10 to start with, then units of 100. It is suggested that instruction on the meaning of decimal fractions start with such measuring experiences. First, the student may be supplied with strips of paper divided into ten equal squares. Parts of the whole strip are then expressed in terms of tenths of the whole, written as common fractions, then as decimal fractions. Or, mimeographed series of lines divided into ten equal segments can be furnished to the student with directions to draw heavy vertical lines to show 3/10, 9/10, 4/10, etc., the equivalent decimal notations then being entered opposite the corresponding drawings. Later on, squares of graph paper with ten equal squares to the side may be used in a similar way to develop the meaning of hundredths. Parts of the whole square can be blackened to show 7/100, can be dotted to show 21/100, can be crosshatched to show 37/100, and so on, the common fractions then being translated into decimal equivalents.

Once experiences in direct measurement by means of decimal units have contributed their share of meaning to the understanding of decimal fractions, it is time enough to introduce the general relation between decimal fractions and equivalent common fractions, e.g., $\frac{3}{4}$ and .75, $\frac{2}{3}$ and $.66\frac{2}{3}$, etc. These relationships will hardly be understood if the learner merely memorizes the common fractional and decimal equivalents. First, the student needs to know how to translate common fractions into decimals, as well as the reverse process, beginning with the more common decimal and fractional equivalents and continuing with less common pairs, e.g., $\frac{5}{9}=.55\frac{5}{9}$, $\frac{3}{7}=.42\frac{6}{7}$, etc. Supported by this understanding which will enable him to find the correct fraction or decimal if he forgets it, the student may then safely be encouraged to memorize a dozen or more of the commoner pairs of equivalents.

It is frequently said that the principles governing the writing of decimal fractions are the same as those governing the writing of whole numbers, and therefore that learning the former skill requires merely the extension of what is already known about whole numbers. These statements are true, but they are likely to oversimplify the learning situation and to blind teachers by false inferences. In the first place, this statement rests upon the assumption that students, when they come to decimal fractions, *have* something to extend. This assumption may or may not be valid. It is possible to read and write whole numbers with but the slightest grasp of the principles of place value. In the second place, the extension so hopefully expected does not seem to be made as easily as is anticipated. Even children who understand place value in whole numbers seem to have plenty to learn about reading, writing, and interpreting decimal fractions,—else why their errors? The truth is that this extension *is* a simple matter to the person who has made it, but it is not so simple to the one who is making the extension.

The foregoing statements do not imply that it is impossible to teach the meanings of decimal fractions or to utilize knowledge of place value previously acquired. The purpose of the statement is, rather, to emphasize the fact that there *is* a teaching task in connection with the meanings of decimal fractions and the abilities to read and write them, a task which is ignored or minimized only to the detriment of the student. It is not enough that the student be able correctly to read and write .4, .04, and .004. To be protected from absurdities of interpretation the student must understand the relationships as well as the differences among these expressions. As has already been suggested, these relationships rest in part upon sound concepts of fractions and in part upon a functional grasp of place value The decimal fraction .4 cannot have the same value as .04 because .4 means 4/10 while .04 means 4/100; or, the 4 of .4 is in tenths' place and means 4 tenths and the 4 of .04 is in hundredths' place and means 4 hundredths. Yet, the two expressions at the same time are alike in the sense that the 4 in both decimal fractions is a numerator. In 4/10 and in 4/100 the denominator is apparent; in .4 and .04 the denominator is not apparent but implied. Difficulties in reading, writing, and interpreting decimal fractions will certainly arise if the student does not understand that the *places* of the significant figures in decimals give him the implied denominator.

One further word about the meanings of decimal fractions. The student needs to understand such relationships as: (1) for abstract numbers, $.4 = .40$, or .400; (2) for measurements, .496 and .516 are approximately, although not exactly, equal to .5 (5/10), or to .50 (50/100), or to .500 (500/1000); and (3) as relative magnitude, .4 is more than .39 and less than .402. These relationships are vital; they are found commonly in Army and civilian jobs. Difficulty of interpretation is likely to result from the fact that the equal and unequal decimals contain varying numbers of digits. Instruction on the meaning of decimal fractions must include attention to these and similar relationships.

Per cents.

The phrase, "a 2% slope," should mean to the soldier a slight rise in the terrain. In such an application of per cents. which is common and important both in Army and in civilian life, we come face to face again with the problem of meaning. Moreover, when per cents occur as parts of more complex situations which require computation (see Section F), the meaning of per cents is even more crucial.

Before the student studies percentage, he is usually familiar with such expressions as 3 out of 4, 9 out of 10, 45 out of 50, and the like. Moreover, having studied both common and decimal fractions, he knows that these relationships can be expressed as $\frac{3}{4}$ or .75, 9/10 or .9, and 45/50 or .90, respectively. In these expressions he has used various bases: 4, 10 and 50. The problem in teaching percentage is to show the student that *all* bases can be standardized to 100, so that the parts are known as hundredths or per cents.

The last statements imply more than mechanical facility in dividing numerators by denominators in the case of common fractions and pointing off the answers to two decimal places, and in substituting the sign %, written after the number, for the decimal point written before the number in .50 and .73. Mechanical habits alone hardly suffice for translating into per cents such common fractions as 11/3 and 1/27, or such decimal fractions as .1 and .507, to say nothing of 4.007.

The base of hundredths needs to be meaningful in its own right. The preceding section (pages 256–257) contains suggestions for the use of graph paper to teach the meaning of two-place decimals, and the same materials may be used in the case of per cents. To teach the meaning of per cents from 1% to 100%, a strip of graph paper made up of ten equal squares, each divided into ten equal parts (rectangles) may be used. Each part is 1%, so that fifteen parts equal 15%, sixty-nine parts equal 69%, and so on. To teach the meaning of per cents smaller than 1%, a strip of graph paper ruled 10 squares to the inch and 10 inches long will provide a total of 1000 small squares. Each of the small squares is 1/1000 or .1% of the whole, and practice can be given in designating such per cents as .9%, .5%, etc.

Meanings of per cents larger than 100% are also important in the Army and in civilian life, and should therefore be taught. In the Army the chief use of such large per cents is restricted for the most part to expressions of ratio. In the expression 6 is 150% of 4, the relationship, not at first apparent, becomes apparent if 6 is first thought of as 1.5 times 4. In civilian life the problem of buying for $4 and selling for $12 involves the relationship of 300% if selling price and cost are compared (12/4, or 3/1), and of 200% if gross profit and cost are compared (8/4, or 2/1).

B. Counting
(Item 5)

It might well be assumed that prospective inductees will know how to count. It does not necessarily follow that they can use counting efficiently in practical situations. This functional use of counting implies the abilities: (1) to place with accuracy a group of objects in a one-to-one correspondence with the natural numbers; (2) to count by units of such groups as 2's, 4's, 5's, and 10's; and (3) to recognize identical units and find the total by multiplication.

The ability to determine the one-to-one correspondence between a group of objects and the natural numbers demands something more than rote counting. It implies that thorough familiarity with numbers which has been previously noted as mathematical sense together with such an orderly procedure as tallying (see Section P, page 280).

The ability to count in such multiple units as 2, 4, 5, or 10 is not only useful in many Army and civilian tasks but also serves to provide enriched concepts of number and a more thorough appreciation of factors, of multiples, and of products.

Instead of counting by other groups such as 3, 6, 7, or 9, a sensible recognition of number will direct the student to count the number of such groups and use multiplication. Thus if a group of soldiers march aboard a transport in ranks of 3, the counter would determine the number of ranks of 3 and find the total by multiplication.

In any case the ability to count with assurance and skill implies a familiarity with number, with units of multiples of number and with tallying. Only thus can the practical aims of minimum Army needs be met. This does not mean that there is no value in having the student count by units of 3, 6, 7, or 9. Counting by such units provides excellent practice in adding by endings, and in proceeding from decade to decade concepts of number are more enriched than when the individual counts by 1's.

C. Operations with Whole Numbers (Items 6–9)

Computation.

Our methods of computation and the forms (algorisms) we use are based directly upon the fact that ours is a decimal system, with 10 as the base. Consider the following computations:

A.	B.	C.	D.	E.
49	72	56	39	32
+36	−37	×7	×24	8)256
85	35	392	156	24
			78	16
			936	16

In A, when we add 9 and 6 in the ones' column, we secure the total of 15 (ones), which we then break up into one ten and 5 ones. The 5 ones are represented in the sum by the 5, which is written in ones' place. The one ten is carried to the tens' column where it is combined with 4 (tens) and 3 (tens) to give 8 (tens). We do not carry "1"; instead, we carry "1 ten," and we then write the total of 8 under the 4 and 3 because we must: the 8 stands for 8 tens.

In B, we cannot subtract 7 (ones) from 2 (ones), so we borrow ten (not "1") from the 7 (tens), leaving 6 (tens). The subtraction continues, 7 from 12, 3 from 6; and the digits of the remainder are written where they must be written—5 in the ones' place, 3 in the tens' place. These positions are dictated by the fact that they stand for ones and tens, respectively.

In C, the first multiplication (7×6) yields 42, which may be thought of as 4 tens and 2 ones. The 2 for the ones is written under the 6 and the 7, because they, and the 2, must be in the ones' column. The 4 (tens, not "4") is carried, and is added to the next product which is not 35, but 35 tens. Hence, the digits in the sum 39 (tens) must be written with the 3 in hundreds' place and the 9 in tens' place.

In D, the second partial product (78) is really 78 tens, for it results from multiplying 39 by 2 tens (the 2 of 24). For this reason, and for no other, the 8 must be placed in the tens' column and the 7 in the hundreds' column.

In E, the first partial dividend is really 25 tens, and not 25. Hence, the quotient figure 3 must be written in the tens' place, above the 5 and the 4, which are already in the tens' column. And the second quotient figure, 2, can go nowhere else than above the 6 in the ones' place, because the second division is 16 (ones)÷8.

Such is the rationale of the five computations, a rationale which is derived directly from our decimal number system. This rationale can be understood only if one already understands the composition of whole numbers in terms of place value. Mechanical habits of computation and the rules that go with them serve so long as (1) they are remembered and (2) they are employed in completely similar situations. But intellectual habits which are not built upon understandings are notoriously easy to forget,—as witness the great losses in computation on the part of adults and high school students. Moreover, one rarely uses mathematics in situations which resemble closely those in which it was learned. To the student of mathematics who believes in meaningful instruction, it is not surprising that enlisted men are frequently incompetent in simple arithmetical computations with whole numbers, nor that they are even less competent when computing with common and decimal fractions and when using per cents.

The mathematics course for prospective inductees should not be restricted to drill in computation. Unenlightened drill will carry the student no further than the point which he has previously attained and will subject him again to immediate and drastic losses. Instead, teachers of mathematics should see that their students acquire the meanings and understandings which will protect them against losses and will make them capable of intelligent behavior in quantitative situations.

Approximation and estimation.

Understanding of the number system, of the functions of the fundamental operations, and of principles governing computation is of great assistance in estimation and approximation. In this connection, the student needs to know the effect of the operations on the whole numbers with which he deals. When whole numbers are concerned, in addition the answer is larger than is any addend; in subtraction, the answer is smaller than is the minuend; in multiplication, larger than either the multiplier or the multiplicand; in division, smaller than the number divided. Exceptions arise of course when 0 is added, subtracted, multiplied and divided.

Knowledge of these relationships allows one to detect at once the absurdity of such answers as: 66 for $89+23$; 63 for $38-25$; 340 for 5×468; 631 for $462\div 2$. Knowledge of these relationships, together with understanding of the number system and of computation, enables the student to tell without paper and pencil that the sum of 389 and 512 must be in the neighborhood of 900 (389 approximates 400; 512 approximates 500); that the difference between 849 and 763 must be nearer 100 than it is 350 (the example is approximately $850-750$); that the product of 8 and 78 must be about 640 (78 is nearly 80), and that the quotient when 596 is divided by 7 will be more than 75 and less than 100 (596 is about 600).

The ability to detect absurdities and to know what are reasonable answers for given number relationships is important in the Army. Evidence which supports this statement was continually met. Much of this evidence, at the same time, revealed the importance of mental arithmetic (calculation without pencil and paper).

Problem-solving.

When one performs abstract computations, one is always told precisely how the numbers are to be treated. For example, in the case of addition, one sees the addition sign or the word *sum* or *add*. In subtraction, one sees the subtraction sign or the word *remainder, difference,* or *subtract*.For multiplication and division there are comparable cues. In computation therefore the student, no matter how mechanical his habits, is not confused by the need to decide which process to use: the cues tell him.

Such, however, is not the case when the student deals with problems, whether the problems are encountered in school or outside. Consider the following verbal problems, stated for the sake of brevity in textbook form, which parallel the abstract examples discussed above:

A. If you count 49 pairs of shoes on one shelf and 36 pairs on another shelf, how may pairs did you count on the two shelves?

B. If only 37 men of a detail of 72 report on time, how many are late?

C. If it takes 7 men 56 hours each to complete a job, how many hours of work are required in all?

D. If socks sell for 39¢ a pair, for how much would 2 dozen pairs of of the same kind sell?

E-1. If you can pack 8 shells in a box, how many boxes will be needed for 256 shells?

E-2. If 8 details of the same size are to to be made up from 256 men, how many men will there be in each detail?

Where, in Problem A, is the addition sign, *add*, or *sum?* Where, in Problem B, is the subtraction sign, *difference*, or *subtract?* And where in Problem C to E-2 are the cues for multiplication and division? Obviously, they are not present. Instead, the student must have some way in which to determine for himself the process to be used in each problem.

It is precisely here that the student, however skilled in mechanical computation, tends to fail in problem-solving: tell him what process to use and he will (or may) secure the correct answer, but he cannot decide for himself the process which is required. The teacher in the intermediate grades recognizes the comparable situation when her pupil comes to her with the question, "Yes, but do I add, or subtract, or multiply, or divide?" It is most unfortunate that the significance of this question is not grasped. If it were, the child would not be *told* what process to use, but would be guided toward the correct decision in a way which would have permanent good effects.

The fundamental operations are simply mathematical methods of answering a few basic questions. (1) We *add*, when we must answer the question, "How many in all?", "What is the total?", or something similar, and when the numbers involved are not of the same size. (2) We *subtract*, when our question is, "What is the other part of the number?", or "What is the difference?" (3) We *multiply*, as we add, in response to the question, "How many in all?", or "What is the total?", when the numbers are of the same size. (4) And we *divide* to answer two questions: (a) "How many times does this larger number contain the smaller?" (for example, note Problem E-1 above), and (b) "How many are there in an equal part or share of a number when there are so many parts or shares in the whole?" (see Problem E-2 above).

True, the learning situation seems to be over-simplified when each process is said to answer one or two questions. Actually, the number of language forms which set the need for each process is very large; but all the different language forms for a given process can be reduced to one or two basic questions. The teaching task, therefore, is not to prescribe vocabulary drill on a few language forms nor to try to find all possible language forms for each process, but to supply experiences with enough different forms to develop familiarity with the generalized question or questions. Equipped therewith, the student is able to deal effectively and confidently with practically any need for each process, no matter in what words the need is couched.

Teaching the meanings of the operations.

The basic meanings of the fundamental operations are readily taught if simple, concrete, practical situations are used, preferably situations which may be represented with objects or by drawings or dramatization. When the learner actually *combines* two groups of 5 persons and 7 persons to get a total, by forming from them a single larger group, he sees at once (1) the nature of the process (combination of numbers of unequal size), (2) the kind of occasion which calls it forth, and (3) the effect of the operation on the original numbers, with the relation of the answer thereto. Likewise, when the learner actually makes up 6 equal sets of books from a total of 72, in response to the question, "How many sets of 6 books each can I get from 72 books?",—when he actually counts out the books (real books, or symbolic objects for them), he gains insight into the process of division.

Nothing is gained in teaching the meanings of the processes by using very large numbers, for these meanings are less apparent when the extra factor of large numbers is present. Nor should purely abstract situations be used at first. Later on, such abstract situations are warranted, but the number relationships in such situations should at first be presented as tangibly as is possible, in order to make the transition easy. It takes time for meanings to develop, time which must be filled with appropriate experiences.

D. Operations with Common Fractions[6]
(Items 10–13)

Providing the student has real understanding of the various meanings of fractions, of reduction of fractions, and of equivalent fractions, he should readily learn how to compute with common fractions. Without these understandings, he can acquire only mechanical skills which are forgotten as quickly as they are "learned,"and which in any circumstances are scarcely serviceable. On the other hand, equipped with these understandings and given adequate practice, he will need to learn little more than the idea of the common denominator in order to add and subtract (and possibly to divide) with fractions. Multiplication by and of common fractions raises few difficulties, save as indicated below; and a real understanding of this process will forestall confusion with other processes.

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[6] For the sake of brevity, mixed numbers as such are not included in this report. It is assumed that the teacher of mathematics will

The concept of the common denominator is an extension of the ideas of reduction and of equivalent fractions. Indeed, within the range of denominators usually met in the Army, common denominators are virtually taken care of by these ideas. But at this point it is desirable to extend instruction beyond the minimum in two respects. (1) It is important to teach the meaning and function of the common denominator,—what it is, why it is needed, what it does for us that could not otherwise be done. (2) Occasionally Army inductees must deal with fractions not in the minimum list, under conditions which call for the common denominator. To prepare for such instances it will usually suffice to have students multiply the largest given denominator by 2, or by 3, and so on, until they have found the common denominator.[7] Finding the common denominator by the method of factoring need not be taught for minimum Army use, or for most uses in civilian life.

Once the common denominator has been found, addition and subtraction should go forward smoothly, answers always being expressed in terms of the common denominator or a reduced form thereof. Use of the common denominator can also be recommended for teaching division by and of a fraction. When a fraction is the divisor, the usual rule, "Invert the fraction and multiply," is taught immediately without rationalization. Thus, $\frac{4}{9} \div \frac{5}{6}$ becomes $\frac{4}{9} \times \frac{6}{5}$. If the common denominator method is used first, the example $\frac{4}{9} \div \frac{5}{6}$ becomes $\frac{8}{18} \div \frac{15}{18}$, and the answer is seen to be $\frac{8}{15}$, since the denominator 18 is common to both numerators, 8 and 15, and can therefore be disregarded. Later on, the inversion method can be taught to those who can profit by it for precisely what is, a short cut which yields the correct answer with a minimum of time.

Estimation and approximation.

With common fractions, as with whole numbers, it is not always necessary (and it is frequently impracticable) to use paper and pencil to find answers in Army situations. In such cases the individual must estimate and approximate, and he will be successful in so doing only to the extent (1) that he understands the meanings of fractions and (2) that he knows the effect of the fundamental operations on the fractional values with which he deals. The first has been treated in a separate section above; the second needs explanation.

When one adds whole numbers, the sum is larger than is any addend. This relationship holds also in the addition of common fractions. So does the corresponding principle for subtraction: the remainder or difference in subtraction is smaller than the quantity subtracted from, whether whole number or common fraction. But not so for the relationship between factors and answers in multiplication and division, where the situation with respect to whole numbers differs from that for common

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know how to apply the suggestions given to operations with such numbers. Similar considerations seem to justify the omission of any discussion of mixed decimals (4.7, 20.054) in the following section (Section E).

[7] This method will not be efficient in some Army jobs, as for example, indexing on a milling machine, where it is at times necessary to find the common denominator for fractions with such denominators as 19 and 21.

fractions. When two whole numbers are multiplied, the product is larger than is either number; when divided, the quotient is smaller than is the number divided. The differences in the case of computation with fractions can be made clear by analyzing relationships like those below.

When we multiply a whole number by a proper fraction (see A below) or a fraction by a proper fraction (see B), the product is smaller than the multiplicand. When we multiply a fraction by a whole number, on the other hand, as in C, the product is larger than the multiplicand, for obvious reasons.

$$\begin{array}{ll}
\text{A.} & 4\times 6=24 \\
 & 2\times 6=12 \\
 & 1\times 6=\ \ 6 \\
 & \frac{1}{2}\times 6=\ \ 3 \\
 & \frac{1}{4}\times 6=1\frac{1}{2} \\
 & \quad\text{etc.}
\end{array}$$

$$\begin{array}{ll}
\text{B.} & \frac{1}{2}\times 1\ =\frac{1}{2} \\
 & \frac{1}{2}\times\frac{1}{2}\ =\frac{1}{4} \\
 & \frac{1}{2}\times\frac{1}{4}\ =\frac{1}{8} \\
 & \frac{1}{2}\times\frac{1}{8}\ =\frac{1}{16} \\
 & \frac{1}{2}\times\frac{1}{16}=\frac{1}{32} \\
 & \quad\text{etc.}
\end{array}$$

$$\begin{array}{ll}
\text{C.} & 4\times 6\ =24 \\
 & 4\times 3\ =12 \\
 & 4\times 1\frac{1}{2}=\ \ 6 \\
 & 4\times\ \frac{3}{4}=\ \ 3 \\
 & 4\times\ \frac{3}{8}=\ \ 1\frac{1}{2} \\
 & \quad\text{etc.}
\end{array}$$

When we divide a whole number by a proper fraction (D) or a fraction by another proper fraction (E), the quotient is larger than the dividend. When we divide a fraction by a number larger than 1, as in F, the quotient is smaller than is the dividend.

$$\begin{array}{llllll}
\text{D} & 12\div 4=\ \ 3 & \text{E.} & \frac{1}{2}\div 1\ =\frac{1}{2} & \text{F.} & \frac{1}{2}\div\ \ 1=\frac{1}{2} \\
 & 12\div 2=\ \ 6 & & \frac{1}{2}\div\frac{1}{2}\ =1 & & \frac{1}{2}\div\ \ 2=\frac{1}{4} \\
 & 12\div 1=12 & & \frac{1}{2}\div\frac{1}{4}\ =2 & & \frac{1}{2}\div\ \ 4=\frac{1}{8} \\
 & 12\div\frac{1}{2}=24 & & \frac{1}{2}\div\frac{1}{8}\ =4 & & \frac{1}{2}\div\ \ 8=\frac{1}{16} \\
 & 12\div\frac{1}{4}=48 & & \frac{1}{2}\div\frac{1}{16}=8 & & \frac{1}{2}\div 16=\frac{1}{32} \\
 & \quad\text{etc.} & & \quad\text{etc.} & & \quad\text{etc.}
\end{array}$$

The analysis which should accompany the presentation of each series of relationships includes a search for the *reason* for the effect of the operation on multiplicand and dividend. In A, we have a constant (6), and we want to find how many are obtained by combining the group an indicated number of times or by taking part of it. In B, the constant is the fractional multiplier; hence, the total obtained must always be less than the part represented by the multiplicand. In C, the constant is the multiplier (4), and as a consequence the product is always larger than the fractional multiplicand. In D, the question is, "How many 4's, 2's, $\frac{1}{2}$'s, $\frac{1}{4}$'s, are there in 12?"; in E, "How many 1's, $\frac{1}{2}$'s, $\frac{1}{4}$'s, etc., are there in $\frac{1}{2}$?", and the quotient must steadily become larger; in F, "How large a part do we get when we divide $\frac{1}{2}$ by 1, by 2, etc.?", and since the divisor is 1 or more than 1, the quotients must steadily decrease in size.

When the computations are viewed in these terms, the operations make sense, the answers can be checked for reasonableness, and the student is not likely to accept such absurdities as: $\frac{1}{2}\times 8=16$, or $8\frac{1}{2}$; $\frac{1}{4}\div 8=32$, or $8\frac{1}{4}$; $10\div\frac{1}{2}=5$, or $9\frac{1}{2}$; and so on. Without the needed understandings, the answers just listed are as reasonable as any others.[8]

Problem solving.

Practical situations in which one computes with common fractions may be grouped under two headings: (1) those resembling the corresponding situations in which whole numbers are used and (2) those involving the special understandings contained in the "part-whole" relationship. Type (2) is fully discussed later (Section F). With respect to type (1) little needs to be added to the foregoing paragraphs. The student who has rich concepts of fractions and who understands the fundamental operations and their effects upon the values dealt with,—such a student should face problems as contrasted with abstract computations with considerable equanimity. He needs only to be provided with ample practice and with many varied experiences in using common fractions, in order to complete his learning. What has been said previously in this connection with regard to whole numbers, applies equally well here.

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[8] The high school teacher will recognize this as an excellent opportunity to teach the variation in a function as one of the variables increases or decreases in value.

Suggestions for teaching.

Instruction in fractional computation, like that with whole numbers, should start with concrete representation,—real objects (e.g., apples) which can be divided and combined in various ways, symbolic materials (e.g., paper cut-outs), or drawings and diagrams. There is no fractional computation which cannot be objectified in some manner. The advantages which accrue from objective presentation are those of clarity and of verifiability. With the beginning of instruction on each skill (and for some time thereafter, at increasingly longer intervals) abstract fractional relationships ($\frac{2}{3}+\frac{1}{4}$; $4\frac{7}{8}-2\frac{1}{6}$; $\frac{5}{9}\times\frac{3}{6}$; $\frac{4}{5}\div\frac{2}{3}$) should be translated into some type of concrete form, and solutions should be arrived at on this basis. After this, they may be translated back again into abstract terms and the answers found through the use of numbers.

E. Operations with Decimal Fractions[9]
(Items 14–17)

Computation and problem-solving with decimal fractions differ little from computation and problem-solving with whole numbers. With both, the separate digits of the numbers must be written with rigidly careful attention to place-value, no more so for decimal fractions than for whole numbers. It is only because we customarily omit the decimal point in writing whole numbers (and because, unfortunately, we substitute rules for understanding in placing the digits of whole numbers for computation) that something new seems to be added when we compute with decimal fractions (including mixed decimals).

Usually, addition and subtraction occasion no difficulty when the student deals with decimals, if for no other reason than that he has for years added and subtracted money numbers even though he does not recognize these as mixed decimals. Nor do multiplication and division occasion difficulty so long as multipliers and divisors are whole numbers. Trouble appears, however, when multipliers and divisors are decimals; then come errors in pointing off. The trouble is sometimes met by prescribing rules: in multiplication, add the number of places in both factors and point off accordingly in the product; in division, subtract the number of places in the divisor from those in the dividend, and point off this number of places in the quotient; or, clear the divisor of decimals by multiplying by a power of 10, multiply the dividend by the same factor, and divide as with a whole number divisor.

These rules have their place, but they do not cover all essential learnings. At the least, they should be derived by setting up series of relationships, as in the case of common fractions, like the two series below:[10]

$$\begin{array}{lr@{\;}l@{\qquad}lr@{\;}l}
\text{A.} & 3\times 8 & =24 & \text{B.} & 16\div 4 & =4\\
 & .3\times 8 & =2.4 & & 16\div .4 & =40\\
 & .03\times 8 & =.24 & & 16\div .04 & =400
\end{array}$$

These analyses can be given a firmer foundation if the more familiar common fractions are first substituted for the decimals in the series above, and if the operations are performed to show what the values of the answers must be. Once the understandings have been developed on a fractional basis, decimals may be re-substituted, the answers found, the rules deduced, and the figures in the answers pointed off accordingly.

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[9] There is no corresponding section for "Operations with per cents," for we rarely add, subtract, multiply, and divide per cents as such, and when we do, we compute with them as with whole numbers. Uses of per cents are pretty well limited to the "part-whole relationship" which is treated later (Section F).

[10] Here again is an opportunity to show variation.

That computation and problem-solving with decimal fractions is an unsolved mystery for many students is easily established. When students must labor over such simple examples as .64÷.32 (which should be solved by inspection) and when they complacently accept the absurd answers which their unenlightened computations yield them,—when these conditions prevail, it is clear that instruction in decimal fractions must be radically re-oriented. Decimal fractions must themselves be much better understood (this need is discussed above in Section A), and this understanding must be based upon (1) the ideas involved in common fractions and (2) upon an understanding of place value. There is then little required except to make students competent in abstract computation and in solving problems with decimals.

F. Part-Whole Relationships
(Items 18–20)

Part-whole relationships in mathematics are of three kinds: (1) to find a part of a quantity; (2) to find what part one quantity is of another; and (3) to find the whole quantity when a part and its relative size are known. Teachers will recognize here the familiar three cases of percentage, the first two of which are commonly taught, the third less commonly. These three part-whole relationships, however, are by no means restricted to percentage. Finding 40% of 60 is no different essentially from finding .40 of 60 or from finding $\frac{2}{5}$ of 60. That is to say, the three expressions denote the same idea. Indeed students who well understand common fractions, decimals, and per cents will choose that form which leads most easily to the answer. In any case the solution is the same whether $\frac{2}{5}$ of 60, .40×60, or 40% of 60 is found no matter in which form the problem is stated. Similarly, finding what per cent 6 is of 12 is, in its basic meaning, no different from finding what decimal part 6 is of 12, or what fractional part it is; and finding the whole quantity when 5 is known to be 30% of a number has the same meaning as finding the whole quantity when 5 is known to be .30 of the whole or 3/10 of the whole.

The custom of postponing all consideration of part-whole relationships until percentage is taught and then of limiting these relationships exclusively to percentage is a mistake. One of the most common uses of fractions occurs in such examples as: $\frac{1}{4}$ of 4 is ?, $\frac{3}{8}$ of 24 is ?; and the relationship here is of the first type (Case 1) whether we so designate it or not. In similar fashion we actually use common fractions in school before per cents are taught, in part-whole relationships of the second and third types. What is needed is to recognize these facts and to re-organize the teaching so that this three-fold interpretation of part-whole relationships can be unified. Thus the illustrations given of the three types of part-whole relationship have all been of the common form, when the part to be found, or part of the quantity to be found, or the part known is less than 1. But part-whole relationships also occur of course in which these factors are more than 1. For example, we may want to know 5/2 (2.5 times, 250% of) a number, or to find what part (fractional, decimal, or per cent) 75 is of 30, or to find the whole, knowing that 8 is 5/4 (1.25 times, 125% of) the number. Instruction needs to be given with these latter kinds of example, as well as with the first mentioned. In the discussion which follows, comments are, however, limited to the first kind of example, purely in the interest of brevity.

Finding a part of a quantity.

As has already been said, the student first encounters this particular part-whole relationship in the fractional form of expression. Having found $\frac{1}{5}$ of 10, $\frac{1}{4}$ of 16, etc., many times, he has little difficulty in recognizing the relationship as one of division. The extension to $\frac{3}{8}$ of 20, $\frac{7}{8}$ of 24, etc., should be natural: division is still implied; but the substitution of the sign × for "of," as in $\frac{3}{5}\times 20$ and $\frac{7}{8}\times 24$, seems to change the idea to that of multiplication only. Actually, the fundamental idea remains that of division. Consider the solutions:

$$\text{(a)} \qquad \frac{7}{\underset{1}{\cancel{8}}}\times\overset{3}{\cancel{24}}=21,$$

wherein we divide 24 by 8, then multiply the quotient by 7; and (b) $7\times 24=168$; $168\div 8=21$, wherein we multiply first, and then divide.

When the student begins work with decimal fractions, he again meets what we may call Case I, in such examples as: Find .75 of 20. It should be at once pointed out that he has already solved many examples of this kind and that only two aspects of the situation are new: (a) the operation is performed with decimals instead of with common fractions, and (b) it is performed by multiplication. True, $\frac{3}{4}$ of 20 and $\frac{3}{4}\times 20$ do not look like $.75\times 20$ and $\times.\underline{\tfrac{20}{75}}$, but the result is the same because we are multiplying by a number less than 1. This relationship is easily established if a few examples are solved first with common fractions, then with decimals.

Last of all, Case I is met when percentage is introduced. By now the nature of the part-whole relationship should be entirely clear, so that it should be necessary only to show the correspondence between (a) the percentage expression and the solution by per cents (hundredths) and (b) the familiar procedure with decimals.

Finding what part one quantity is of another.

When the part-whole relationship takes the form, "5 is what part of 6?", we are really dealing with the second fraction idea which was developed in Section A, namely, with the idea of the fraction as an indicated division. If this idea is well taught as part of the meaning of the fraction, the part-whole relationship in Case II is already about understood,—but only with the fractional form of stating the relationship. When operations with decimal fractions are taught, it remains to show the equivalence of the new form, "5 is what decimal part of 6?" to the more familiar fractional form of expression. The first few examples of Case II with decimals might well be solved by common fractions until the equivalence is clearly grasped and the student realizes that he is learning, not a new idea, but a different way of dealing with a familiar idea. So taught, the student does not then come upon Case II in percentage as a strange notion. Instead, he can relate this use of per cents to the corresponding use of decimal fractions.

Finding a quantity, given a part and its relative size.

Of the three part-whole relationships, Case III is met with less frequently than are Cases I and II. For this reason, and also because it is "hard" for students, Case III is much less commonly taught. For the minimum needs of the Army (and of civilian life) Case III is not absolutely essential; but the relationship, in all probability, would be much more widely used if it were learned in a meaningful and useful manner.

If the relationship is first presented with common fractions, e.g., "If 6 is $\frac{2}{3}$ of a number, what is the number?", the procedure is that of unitary analysis. Since $\frac{2}{3}=6$, $\frac{1}{3}$ is 3 (because $\frac{1}{2}$ of $6=3$); hence, $3/3=9$ (because $3\times 3=9$). This procedure requires the understanding of simple equations, but this obstacle is not insuperable.

The method of unitary analysis does not seem to be so helpful if one tries to solve Case III examples directly by decimal fractions, as, for example, in: ".5 of a number is 8; what is the number?" However, if the student substitutes common fractions,

$$\tfrac{50}{100}=8;\ \tfrac{1}{100}=\tfrac{8}{50};\ \tfrac{100}{100}=100\times\tfrac{8}{50},\text{ or }16,$$

n these circumstances the method of unitary analysis is seen to be applicable; but this does not necessarily lead to the understanding that the solution of $8 \div .5$ is the same thing. For this reason, with both decimal fractions and per cents, it is suggested that the algebraic method be used, letting x stand for "the unknown number." Then the solution takes the form

$$\begin{array}{llcll} \text{(a)} & .5x=8 & \text{or} & \text{(b)} & 50\%x=8 \\ & .1x=1.6 & & & 1\%x=.16 \\ & x=16 & & & x=16 \end{array}$$

G. Ratio and Proportion

(Items 21–22)

The inventory of Army needs revealed that, as in civilian life, the concept of ratio has wide application. The soldier is confronted with many situations like the following: "25% of the gasoline must be held in reserve," "10% of all parachutes on hand must be kept packed," and "The recipe will provide for 25 men and must be increased in proportion to the number in the mess." These are but a few examples of the many problems in which the idea of ratio is explicit or implicit.

Without a clear concept of ratio, proportion cannot be understood. The ratio idea, however, seems to be difficult for many students, perhaps because ratio involves the measurement of one amount in terms of another amount and the comparison is made by division. Comparisons made by finding differences between amounts are obviously less complicated. For example, to say that "4 is 8 less than 12" seems to be more readily understood than to say that "the ratio of 4 to 12 is 4/12 or $\frac{1}{3}$." Yet, this difficulty could be materially reduced if the idea of ratio were not postponed as long as is common, namely, to the time when ratio is used in computation. If, instead, the idea of ratio were developed as one of the meanings of common fractions (see Section A), the student would be better prepared.

To have competence in the use of ratio and proportion the student must know that: (1) a ratio is obtained when two like quantities are compared by division; (2) ratio can be expressed in different ways; (3) equal ratios form a proportion, and proportions help in the solution of many practical problems.

(1) Ratio arises from a comparison of two like measures, inches with inches, feet with feet, quarts with quarts, dollars with dollars. The unit in which the comparison is made must be the same for all terms. Implied in these statements are two facts: (a) only like measures or units can be compared, and (b) the resulting ratio is an abstract quantity. For example, the ratio of 2 ft. to 10 in. is determined by expressing both terms first in inches; it is then expressed as 24/10 or 12/5: and these numbers have nothing to do with feet and inches. Likewise, the ratio of 12¢ to $1.44 (changed to 144¢) is 1/12, and this ratio has nothing to do with cents and dollars.

(2) A ratio can be expressed in a number of different ways. For example, the ratio of 2 ft. (24 in.) to 10 in. can be expressed as 12/5, as 2.4, or as 240%, and these forms are equivalent. Likewise, the ratio of 1 gal. (8 pt.) to 1 pt. is 8/1, or 8, for ratios may be abstract whole numbers. The student must have experience with ratio expressed in all these forms. Although the fractional form is adequate for all problem situations, the student should know that the ratio 1/2 can be written in the form 1:2. An extension of the idea is that many simple formulas represent ratios between two variables and that the statement of direct variation as in $y=kx$ indicates that the ratio of y to x is the constant k.

The first step in teaching ratio is the comparison of two amounts which can easily be separated or measured off into discrete units. A start may be made with the problem of dividing 15¢ (3 nickels) so as to give one person twice as much as the other (a ratio of 2 to 1); then of dividing 20¢ in a ratio of 3 to 1, of dividing 25¢ in a ratio of 4 to 1, and so on, the amounts being conveniently measured off in terms of nickels.

The same procedure may be repeated with the division of groups of other objects, with lengths, and the like. The logical step to follow is that of indicating the fractional parts of the whole which result, as for example, 2/3 and 1/3 for the 2-to-1 ratio, 3/4 and 1/4 for the 3-to-1 ratio, and 4/5 and 1/5 for the 4-to-1 ratio. These relationships may be stated somewhat differently as: if the ratio of parts is 2 to 3, then the ratios of the parts to the whole are 2 to 5 and 3 to 5. One part is 2/5 of the whole, and the other 3/5. To divide anything according to the ratio 2:3, we must divide it into five equal parts. Ability to think in terms of parts and the whole is fundamental.

(3) A proportion is an expression of equality between two ratios, and because a fraction has many equivalent forms, any two equivalent forms constitute a proportion. Thus, 1/3 equals 3/9 equals 4/12 equals 5/15, etc. Common ways of expressing proportion are: "The more men put on the job, the greater the amount of work done;" "To increase the amount of the mixture, proportional amounts of the ingredients are needed;" "To enlarge or reduce the size of the picture, the width and length must be increased or decreased correspondingly," etc. In teaching the uses of proportion for minimum Army needs there is no need for such terms as *extremes, means, third proportional*, and the like. However, the expression of proportion in the form $x/4=7/6$ should be known, and the ability to read this form as "x is to 4 as 7 is to 6" frequently supplies a convenient framework for the solution of a problem.

Solving proportions with the aid of literal notation should be stressed. The idea and the skill can be developed by many simple and varied applications, of the types:

(1) If 2 in. represents 13 mi., what does 5 in. represent?

$$\frac{x}{5}=\frac{13}{2}.$$

(2) 400 m.p.h. is how many ft. per sec., it being known that 30 m.p.h. is 44 ft. per sec.?

$$400/x=30/44,\text{ or}$$

$$\frac{x}{400}=\frac{44}{30}.$$

Many simple formulas, as in the expression of direct variation $y=kx$, state that the ratio of the variables, y to x, is a constant. Thus in the formula $d=rt$ when r is fixed, the ratio of d to t is equal to the constant r. The student should recognize the fact that, if $d'=5d$, then $t'=5t$. In a similar manner, without the need for extensive use of the language of inverse variation, the student should see that, if the distance is constant, the rate increases as the time decreases. This idea has been presented earlier in the tables showing the variation when numbers are multiplied and divided (see A, B, C, and D on page 263). A table for a similar purpose may be made for a fixed value of d (say 600) as r takes the values 10, 20, 30, 40, 50, etc. It should be noted, that r becomes twice, three times, . . . as great, t becomes one half, one third, . . . as great.

If time permits, other formulas which will repay the same careful type of analysis are: (1) the law of the lever $L_1/L_2=W_2/W_1$, where W_1 and W_2 are the weight and the force, respectively, and L_1 and L_2 are their distances from the fulcrum; (2) the formula $D/d=n/N$ for expressing the relation between the diameters of two pulleys or gears and their speed of rotation; (3) the formula for an inclined plane $F/W=h/d$ which shows that the ratio of the force F to the weight W is the same as the ratio of the height h which the weight must be raised to the length d of the inclined plane.

The teacher will readily think of other practical uses of proportion which can be used to make the work concrete and interesting, as well as the use of the trigonometric functions to show the slope or grade of a road, the ratio of lead to height in setting guy wires, and others.

H. Powers and Roots[11]

(Items 23–24)

Minimum Army needs with respect to powers and roots consist in: (1) understanding the symbolisms which indicate powers and roots; (2) knowing what powers and roots of numbers are; (3) use of some algorism for finding square roots; and (4) skill in the use of tables of squares and of square roots.

(1) Understanding of the symbolisms for powers and roots, the exponent and the radical sign must be developed so that the student will be able to use them in formulas. He must know that the exponent is an abbreviation for multiplication when the factors are all alike. Adequate practice should assure that the student distinguishes between such expressions as $2a^3$ and $(2a)^3$. Particular attention should be paid to powers of 10 and to the square root of such even powers of 10 as 10^2, 10^4, and 10^6. In this connection, finding the product of decimal fractions by powers of 10 is a good kind of practice. Such practice enriches the student's concept of decimal notation and provides a useful short-cut in computation.

(2, 3) In finding roots, particularly square roots, it is essential that the student have a concept of root so connected with his other mathematical experiences as to be subject to easy recall. This seems to imply a definition related logically to the algorism for finding a square root. The concept of the square root of a number as one of the two equal factors of a number meets the need for definition; and this concept is logically related to finding square root by division.

Thus, to find the square root of 20, one must find two equal factors whose product is approximately 20. The number 4 is too small since $4\times4=16$; the number 5 is too large since $5\times5=25$. So we try 4.5. Dividing 20 by 4.5 gives a quotient of 4.44. The factors (approximate) of 20 are still not equal, being 4.44 and 4.5. But we know that the required equal factors lie between 4.44 and 4.5. So we try as a divisor the average of the two numbers 4.44 and 4.50. Thus the definition of square root is closely connected with the process for finding a square root and a logical bond is established to aid in retaining the concept.

(4) As they are usually printed, tables are serviceable for finding roots and exact powers for the numbers 1 to 100. For larger or smaller numbers, and for mixed decimals even within this range, tables are not so useful. For example, tables do not immediately show the exact square of 8.3; they show only that the square must lie between 8^2 (64) and 9^2 (81), nearer the former than the latter. To find the exact square of 8.3 in a table one must know that $8.3^2=83^2\div10^2$. Similarly, to find the square root of 0.83 in a table, one must know that $\sqrt{0.83}=\sqrt{83}\div\sqrt{10^2}$.

These illustrations show (a) that the usefulness of tables for finding roots and powers, except the simplest, can be easily exaggerated and (b) that the skill required to use tables for these purposes is on a higher level than is commonly thought.

I. Graphs and Maps

(Items 25–28)

The instructors at all camps visited emphasized the need for the ability to read grids and maps as one of the most important of all the mathematical needs of Army men. Strong emphasis was also placed upon the ability to interpret informational charts and simple line graphs. These needs are, of course, quite in line with the rapidly increasing importance of understanding simple graphic techniques in normal civilian life.

What are some of the reasons for the importance given to graphs and maps by training officers in the Army? One instructor made the statement, "There is not a soldier in any branch of the service who will not have to know how to read grids and maps. In fact, the life of any soldier might at some time depend upon that ability." Soldiers must be able to follow routes that have been plotted on maps; they must be able to act in accordance with such directions as: "You are now at (104.6, 217.3). You will proceed to (110.0, 223.8)." They must be able to determine the location of certain critical positions, such as the place where mess is to be served, from a plotted line of march.

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[11] From this point on, the discussions of teaching suggestions for most topics are relatively short. It is assumed that secondary school teachers of mathematics are more familiar with these briefly treated topics than with those related to the teaching of arithmetic. On this account it is unnecessary to provide detailed recommendations.

In order properly to interpret distances pictured on maps, they must understand the basic principles of scale drawing and know how to interpret and use the representative fraction (R.F.) for a given map. They must know that the numerator of any given representative fraction stands for a certain unit on the map while the denominator stands for a corresponding number of units on the terrain mapped. The two representative fractions in most frequent use are 1/20,000, and 1/62,500. Here one unit on the map equals 20,000, or 62,500 units on the ground; these are the actual working approximations of the scales 1 foot = 4 miles and 1 foot = 12 miles, respectively. Another type of scale that needs to be understood is of the form 1 inch = 1 mile, or 1 inch = 5,280 feet. Then, too, there are times when it is necessary to estimate heights of certain points of terrain from a map showing contour lines. Maps are also important aids in artillery fire. Targets may be located on a map; approximate hits may then be plotted and proper corrections made.

Protractors and dividers are frequently used as aids in map reading. Dividers may be used in determining distances or in locating specified points. Protractors are important in determining directions.

As stated above, the simple line graph may be employed to portray the line of march of a body of troops. The broken line graph can be used in figuring times of arrival and distances covered or to be covered in troop movements. For example, if a column of infantry is proceeding at the rate of two and one-half miles per hour, a plotted line of march will locate it at any given time or will tell at what time it will clear certain points along the route.

Required less frequently are the abilities to read direct or alternating current graphs and to interpret the impulse graph of a teletype signal. Although not every soldier will need these abilities, it should be noted that, for those who do use them, they are highly important.

Any prospective inductee can profit from instruction in the reading of graphs and in constructing some of the simpler forms. By the time a student has reached the junior or senior high school he should have been impressed with the importance of graphs. From experience, both self-obtained and teacher-provided, he should have become acquainted with their wide use in purveying information. He probably will not know of the two major dangers of misinterpretation of graphs, and he will need to be instructed with respect to them. (1) Ignorance of simple basic facts in the construction of graphs may cause one to read inaccurately the information which the graph accurately presents. (2) Cleverly constructed graphs can be used deliberately to deceive the careless reader or the reader uninformed in the art of interpreting graphs.

Among the basic facts, simple yet important, in the proper reading of graphs, only three can be treated here. They are as follows:

(1) *The student must know what scale was used in the construction of the graph.* In reading any kind of graph (pictograph, bar graph, etc.) he must know what unit is used. In Cartesian graphs he should understand the frame of reference made by the horizontal and vertical axes and the conventional cross-hatching which is merely a convenient aid to accurate graphing. He should appreciate too the fact that different scales may be set up on the two axes, and should know the basic considerations (such as height and spread of graph, rela-

tive size of units, location of the zero-line or base-line, etc.) which enter into the choice of these scales. He should have a thorough understanding of the use of ratio in determining the best scale to use. This use of ratio, of course, should have been acquired in the study of scale drawing (Section O), and should carry a clear-cut understanding of the representative fraction (R.F.) and its implications.

It should be clear that the understandings mentioned above with respect to graphs are closely associated with those required in map reading. The student should have some opportunity to learn how to approximate distances from the use of maps. The use of highway maps in planning vacation trips and estimating distances traveled could be used to provide very good exercise in such use of scales.

(2) *In graphs that are used to make comparisons the student must know how the comparisons are to be made.* Bar graphs and pictographs are most frequently used for this purpose. Comparisons are not usually difficult to make in the case of bar graphs, for only lengths are to be compared. There are occasions, however, when one is interested in more than a mere relative contrast between the given items. For example, certain lengths, such as the distance necessary under normal conditions to stop a car traveling at different speeds, may be compared in a horizontal bar graph.

(3) *The student should know that line graphs are used to show trends and that conventionally a rise from left to right indicates an increase and that a fall indicates a decrease.* In this connection the following are important: the selection of horizontal and vertical scales; ability to detect increases or decreases and to compare changes over corresponding intervals of time; and the location of the zero-line or base line. Without these understandings proper interpretation of line graphs is improbable.

Up to this point the emphasis has been upon the ability to read and interpret graphs. Very little will be said here about the construction of graphs. A high degree of skill in constructing graphs cannot be listed among the minimum needs of the soldier. However, the student can better appreciate the use of graphs if he knows something about how to construct them. To meet the requirements for the minimum needs presented in this report, the student should have experience in constructing straight line graphs, simple broken line graphs, horizontal and vertical bar graphs, and some very simple circle graphs.

As a final word in this connection, it should be added that fairly often soldiers need to make rough map sketches or drawings. Free-hand drawing, in cases where form is wanted and accuracy is not important, would be an aid toward developing this desired ability. At times it is valuable to follow the making of such rough sketches with the estimation of lengths and possibly of areas represented. Sometimes too these estimates should be checked against the already known values of these lengths and areas or against approximations obtained from more carefully constructed sketches.

J. Tables

(Item 29)

Basically one secures information from a table in about the same way as from a graph. The likeness arises from the fact that in both cases an item of information is found at the intersection of a vertical line, whose position is determined by a horizontal scale, and a horizontal line, whose position is determined by a vertical scale. There is also similarity in the procedure in the inverse problem of finding a number which in both tables and graphs is usually represented in the vertical scale. The skills used are described in Section I.

Tables which seem to be of greatest importance to soldiers are: firing tables, such as those for calculating gun elevation and for making correction for windage; tables of conversion, such as those which give the equivalent values of common and decimal fractions and which indicate the equivalence of degrees and mils; and calculating tables, such as those giving squares, cubes, and square roots. The frequency with which such tables are used in the Army makes it desirable for the inductee to be able to deal with them effectively.

The ability to read tables is as important for civilian life as for Army life. It is therefore an objective for general education fully as much as it is an objective in pre-induction training. It is increasingly common for newspapers and other periodicals to present data in tabular form for the enlightenment of the public.

The tables which the enlisted man and the average citizen are expected to use are usually simple in structure, and the facts or relations to be obtained therefrom customarily are rather easily found. It follows that the abilities to be developed are not difficult to teach. The principal problem is one of assuring a reasonably proficient use of mechanical skills. Speed and accuracy in this skill will result from significant experiences with tables, when provided under conditions which reward accuracy and penalize haste.

Up to this point nothing has been said about interpolation in tables, save in tables of roots and powers (Section H preceding). In this earlier place it was stated that when exact figures (roots and powers) are needed, tables are helpful only to the student who possesses, in addition to the simple skill of reading tables, a considerable degree of insight into the theory of roots and powers as this operates in decimal notation. Here it is sufficient to add that ordinarily the requirements of the practical need are met when the student rounds off to tabular values. As a matter of fact, values in tables frequently involve more significant digits than the data of problems justify using. Those who are to use calculation tables should know that in such cases a great deal of futile effort and many unnecessary sources of error can be avoided by rounding off the table values to the number of significant figures that is warranted.

K. Formulas and Equations

(Items 30–33)

In the Army the minimum requirement for algebra is not much more than the ability to substitute numbers in formulas and to solve very simple equations. In general this means that an understanding of the symbolism of algebra and its use is about all that is necessary. But this symbolism should be learned meaningfully.

Formulas.

The use of symbolism varies from substituting numerical values in such simple formulas as $N=\frac{3}{4}A$ to fairly complicated formulas such as $N=R^3KC$ plus a per cent of N which depends on the size of N, a basic formula used by demolition units. Similarly, in civilian life number symbolism is spread over a wide range of usage and includes the rather complicated formulas of the business and industrial world. Familiarity with the basic principles and the characteristic simplicity of such symbolism certainly is to be classed among mathematical needs, not only of men in the Armed Services, but of every intelligent individual.

Abstractness is an inherent characteristic of all symbolism, no matter how simple. When a student sees the symbol r, for example, he needs aid from some source to enable him to determine whether the number r represents "number of units in radius," "number of units in rate," or "number of ohms in resistance," or any one of many possible measurements. All symbolism should take meaning immediately it is associated with the context from which it is derived. It then follows that symbols, which are to be used to describe a certain situation, should be, where possible, chosen to correspond closely with the legend of the situation. For example, if it is *cost*, *margin*, and *selling price* with which the situation is concerned, then c, m, and s, are the symbols to be used; if it is *area*, *length*, and *width*, then A, l, w. However, teachers should make it very plain that these letters are not abbreviations of words, but are symbols for numbers.

There are certain standard formulas which are of sufficient general importance to justify their being committed to memory. From the point of view of minimum needs of the armed services, the most important formulas to be memorized are the area formulas for circle, triangle, and rectangle; the volume formulas for cylinder and rectangular solid; and the formula for distance, rate, and time.

No treatment of formulas can be considered satisfactory unless some attention is given to the concepts of *constant, variable,* and *dependence.* From the point of view of minimum needs it is sufficient to develop the distinction between *constant* and *variable* with emphasis on the absence and presence of change, and the concept of *dependence* with emphasis on the fact that the value of one variable may depend on the value of another. For example, the distance traveled by an automobile going at an average rate of 35 miles per hour depends upon how long it travels. There are many such simple examples which can be used from life experiences to bring out the concept of dependence as expressed in a formula.

The principal use of any formula is, by substituting certain given, or determined, values of independent variables, to determine corresponding values for the dependent variable. This understanding seems to be a fairly difficult one to acquire. Part of this difficulty may be attributed to inability to perform the fundamental operations of arithmetic, and part to the failure to comprehend the full significance of symbolic representation. Many students who fully comprehend that the symbol 18/6 means that the number 18 is to be divided by the number 6, are unable to interpret a/b as a symbol meaning some number represented by a divided by some number represented by b. This understanding and appreciation may be developed if the student is given experience in setting up formulas to describe familiar situations.

Equations.

As a natural outgrowth of substitution in formulas there arises the solution of equations. For example, if it is known that at a certain height from the ground the circumference of a tree measures 13 feet, the diameter of the tree can be found by solving the equation $13 = 3.14\,d$. The only equations which need receive systematic attention in this outline of minimum needs are the six types of simple linear equations given on page 249.

In developing the concept of what an equation is and how it is to be used, the idea of *balance* should be stressed. An equation can be defined as a statement that two quantities or expressions are equal in value. With this definition it should be fairly simple to point out the necessity for maintaining balance in order to maintain equality. Need for balance may be used as the basis for the meaningful development of the axioms for addition, subtraction, multiplication, and division. Transposition should not be introduced as a technique at all. It might be allowed as a short cut for those who detect it and who fully comprehend the significance of what they are doing. The four axioms should be recognized as no more than corollaries of the more general axiom: "Whenever the value of one side of an equation is changed in any manner whatever, the value of the other side must be changed in the same, or an equivalent, manner. Otherwise, the balance will not be maintained and the equation will be destroyed." This principle should be kept in the foreground, when dealing with equations.

For students who have difficulty in determining what operation is needed to transform equations, the following considerations may be used as guides:

(1) The four fundamental operations of arithmetic may be related in two pairs of *inverse* operations, namely: addition and subtraction, multiplication and division. Any result obtained by a given operation can be *undone* by using the corresponding inverse operation.

(2) To solve a linear equation in one unknown the equation must be transformed so that the unknown will be *alone* on one side of the equation. To do this we must eliminate all other quantities on that side of the equation.

(3) To eliminate these quantities we must *undo* the operations which associate them with the unknown. For example, in $x+4=12$, 4 has been added. Hence to undo this operation, 4 must be subtracted from both sides. Likewise in $x/4=12$, x has been divided by 4. Hence, to undo this operation, both sides must be multiplied by 4.

L. Positive and Negative Numbers
(Item 34)

We are concerned here only with those uses of positive and negative numbers which will meet minimum Army needs. Hence we shall pay no attention to *operations* with such numbers. Men in the armed services do have occasion to understand the nature of directed numbers and their use in indicating opposite qualities and positions. They should therefore know how to establish a zero point and to read positive and negative positions to the right or left, above or below this zero point. They should also know how to read positive and negative angles particularly when related to the north point as zero. Such ability is important in interpreting rifle fire, giving directions, interpreting machine gun firing tables, sighting certain types of guns, and in reading maps and thermometers.

To develop a clear-cut concept of the nature of positive and negative numbers and their characteristics of oppositeness, direction, and position, the most satisfactory approach is to be found in the number scale. Its use should, of course, be supplemented with such familiar concepts as temperatures above and below zero, credits and debits, and income and outgo. The student should not be allowed to think of a negative number as one "whose value is less than zero" and of a positive number as one "whose value is greater than zero." He should understand that a directed number gets its significance through reference to some pre-established zero point, which may be arbitrarily chosen.

M. Measurement
(Items 35–40)

Measurement is so important in both Army and civilian life that it merits extended attention here, the more so since the traditional kind of instruction is quite unlikely to produce the needed concepts and skills.

Concept of a unit.

The history of measurement records the early appearance and use of natural units of measure, such as the cubit (length of the forearm), the foot, the furlong (length of a furrow), the hand, and the yard (the distance from the nose to the end of the outstretched arm). Some of these natural units, only part of them conventionalized, are in use today. The child uses his span in playing marbles, his finger width in choosing sides in a ball game, his foot or stick length in playing *cat*, and his Scout staff in woodcraft. Too, the soldier uses his pace in measuring distance and his finger width in placing a distant object, and he sights along the outstretched finger, first with one eye and then with the other, to judge the number in a column of marching men.

These examples of natural units serve two purposes: they show, first, the nature of measurement, as a process of applying some unit as many times as may be needed to obtain the desired measurement, and, second, the nature of the unit of measure. The latter need not be standardized, provided that exactness is not required and that the final estimate achieved does not need to be used by another whose natural units may be different.

Both of these facts are significant for instruction in the field of measurement. To start with the second fact, initial experiences in measuring should be practical and concrete. At this time the units may quite properly be unconventional. Application of these natural units in significant problem situations will reveal the nature of measurement as a process, without complications from considerations of standard scales. Later on, the shortcomings of natural units should be demonstrated and the advantages of standardized units impressed upon the student. At this stage in learning it is worth while to have the student convert some of his natural units into standard units. For the kind of estimating which he will have to do, either as soldier or as citizen, it is valuable for him to know in standard units the length of his pace, for example, and of his span, the width of his finger, and the finger joint which he should use as being nearest in length to an inch. A further value of this process of conversion is that at the same time it increases the meaning of the standard units themselves.

Common units.

Mere knowledge of the names of common units of measure is of little worth, and memorized tables of such names have no more to recommend them. Yet it is not uncommon to assume that the student who can recite the tables of measure has adequate knowledge of the units and their relationships and has adequate ability to use them in practical situations. How far this assumption departs from the truth is easily demonstrated. Let the teacher send six students to the blackboard to draw the true outline of a pail that will hold a quart. The drawings may vary from the size for a pint to the size for a gallon. Or, let students be asked to estimate the weight of a pile of ten books, or the length of a rope, or the distance between two objects a half-mile apart, or the area of the school lawn. Again many errors will be of fantastic proportions, and the range of estimates will be extreme.

As has been already implied, adequate familiarity with units of measure is best attained by *using* them in concrete settings. It is the teacher's responsibility to provide such experiences. One aspect of this provision is to see that the classroom is equipped with the needed materials—foot rules, yard sticks, 25-, 50-, or 100-foot tape, protractors, meter sticks, compasses, dividers, thermometers, scales for weighing, measuring cups marked with ounces, quart and pint measures, and such others as can be secured conveniently.

The other aspect of instruction is that these instruments actually be used, to the end that the student may learn more about units of measure, more about the process of measurement, and more about the skills involved in estimation (see below) as well as the importance of precision in measurement when exact measures are needed.

Applications.

The word *significant* may be used to characterize the problems in connection with which measurement is to be employed in school. Textbook problems are not significant to the average student. Such problems, suitable for practice at a later time largely to insure proficiency in skills otherwise learned, cannot be significant because they do not arise from personal needs on the part of the student. Hence, if textbook problems are used at all in the early stages of teaching, they should serve chiefly as models upon which to frame more realistic situations for measurement.

The classroom offers some opportunities for the significant application of measurement. For certain needs the dimensions of the room itself and of objects in the classroom may be determined. A mimeographed scale drawing of the classroom may be used for practice in reading such representations, the dimensions on the drawing being measured by dividers and rulers and then checked against the actual dimensions of the room. But in so far as is practicable, experience with measurement should take place out-of-doors. By walking, the student can learn the distance of a mile in terms of time. By measuring a plot of ground in the school yard, he may secure a useful concrete way of thinking of an acre.

Such experiences in measuring also give opportunity to use the tape and the transit. The latter need be only a 12″×12″ board to which a protractor has been attached, the whole mounted on a tripod. This homemade transit can be constructed for a few cents in the school shop and is adequate for most needs. One such transit should be provided for each set of four students. Out-of-door practice in measurement with the transit and with other equipment should extend to the solution of problems by scale drawings or the use of trigonometric functions, according to the ability of the class. In some instances this practice must go beyond minimum Army needs if real competence is to be achieved.

Operations with measures.

Civilians and soldiers alike have to be able to add, subtract, multiply, and divide denominate numbers. As in the case of all other abilities, skill is to be had only from practice. Again, as in the case of all other skills, this practice may be furnished too soon, before the student has sound concepts of units of measure and before he understands what happens practically when he adds or otherwise computes with units of measure. Nothing is gained by setting computational tasks with denominate numbers until need for these operations has been demonstrated and until the operations so applied will make sense to the student. Once this stage has been reached, the student is ready to profit in a real way from practice in computing with units of measure. The practice assigned should include some experience in converting units in one scale into units in another scale. At first this abstract practice may well be checked a few times by reference to concrete experience.

Estimation.

As a matter of fact, the soldier and the civilian make estimates far more frequently than they compute with units of measure or actually measure quantities, distance, weight, and volume. For example, every soldier needs to be able to estimate distances between 100 yd. and 600 yd. in order to set the sights on his gun. Soldiers in Ordnance must be able to select at a glance wrenches of various sizes. Soldiers in the Signal Corps must be able to estimate 100-ft. distances between communication poles and the 11- or 16-ft. clearance of wires over different classes of roads.

The ability to make reasonably accurate estimates depends upon sound concepts of units of measure, natural or standard, and upon adequate experiences in applying these units. Experience in estimating will scarcely be adequate if it is limited to the activities which are usually organized within the walls of the classroom. The value of natural units for purposes of estimation has already been suggested, but the value of these units is greatly enhanced if the user is able to convert them at once into standard units. To illustrate, the soldier who in high school has been a track man may estimate distances in terms of the 50- or 100- or 220-yd. dash. One who formerly was a railroad man may estimate distance in terms of box-car lengths. Still another may estimate the sizes of timbers or the diameters of trees by the span or the width of the hand. Such natural units are seldom recognized and taught in classroom instruction, but their usefulness warrants such recognition.

The chances of successful estimation are increased if the student knows mathematical values well and is familiar with common approximate equivalents. He will find it useful, for example, to know that 17/64″ is a little more than $\frac{1}{4}$″; that 0.035 is half a hundredth less than 0.04; that a rivet 0.316″ in diameter cannot enter a $\frac{5}{16}$″ drilled hole. Among the common approximate equivalents which it is well for the student to know are: a kilometer is about $\frac{5}{8}$ mile; a meter is about 3 in. more than a yard; a liter is a little more than a liquid quart; a gram is about 15 grains; an ounce (apothecaries) is about 31 grams; a kilogram is about $2\frac{1}{5}$ lb.; 5 c.c. equal one teaspoonful;

5 centimeters equal about 2 inches.

Limits of accuracy.

When actual measurement is undertaken, the degrees of accuracy required may vary. In other words, accuracy of measurement is a relative matter. An error of $\frac{1}{4}''$ in the measured length of a 40′ piling is not usually serious, but an error of the same amount in measuring the diameter of a howitzer is likely to be disastrous. This concept of acceptable and unacceptable amounts of error in measurement is known as tolerance and as limits of accuracy. In the meaning of these terms in this report there is no implication that the student must be able through elaborate calculation to determine per cent of error or per cent of relative error. What is implied is that the student must have a common sense understanding of the terms as related to the situations in which they are used. An error of 0.001″ in making a machine part may well be a greater error than an error of 1″ in measuring 100′; an error of 1 grain in weighing a drug or of 1 c.c. in measuring a medicine may be fatal in a hospital; an error of 1° in measuring an angle on a scale drawing may make an error of many yards in an indirect measurement.

N. Geometric Concepts
(Items 41–43)

The mastery of the geometric concepts mentioned in the outline of essential mathematics cannot be obtained by merely memorizing definitions. For each concept there must be enough understanding to guarantee its usefulness and its actual use. Admittedly, the degree to which understanding needs to be carried varies from term to term. It is enough that the soldier in Ordnance be able to identify elliptical and parabolic cams, but for most of the listed geometric terms much more than mere identification is required. In general, the following should be accepted as objectives for instruction: (1) ability to recognize the form, (2) knowledge of its fundamental properties, (3) skill in representing the form by a drawing, and (4) competence in using the form where and when needed in practical situations.

The degree to which the student is able to identify geometric forms and to retain the concepts which he has learned depends upon the number and variety of relationships he is able, under instruction, to establish. In a word, many contacts are required to develop and fix concepts of geometric forms and their properties. These contacts should not be restricted to classroom work with pencil and paper (a caution which has appeared many times in this report), but should include practice in recognizing geometric forms out-of-doors. For example, a telephone line is not straight, but has a sag. Perpendiculars are visible everywhere, as well as natural forms which are approximately vertical.

Whether a line is truly vertical can be determined by a plumb line or by use of the 3-4-5 relationship to something else which is known to be horizontal. Horizontals, which are so important in carpentry, among other jobs, are also somewhat generally visible inside and outside the school. Tests can be applied to determine whether objects assumed to be horizontal are actually so, by use of the level or again by reference to the 3-4-5 relationship, this time to something known to be vertical or perpendicular. Right and isosceles triangles may be located in many natural forms and particularly in architecture, as can also the forms of the cylinder, the cone, the prism, and the sphere. Regular polygons are found in flowers, in vegetables, and especially in snowflakes. In all instances, when the form is recognized, study should be continued to isolate and identify the fundamental properties. In connection with this study it is possible to discover and learn the size of each angle in an equilateral triangle and in a regular hexagon and octagon. It is also possible in this study, if opportunity arises and the need is apparent, to go beyond the minimum list of geometric concepts mentioned in the outline. The tangent and cotangent ratios are used in the Army even when the names of these functions are not employed. The slope or grade of a road is expressed by the Engineers as the *vertical rise* over the *horizontal distance,* the ratio of *lead* over *height* is used in the Signal Corps in attaching a guy wire to a pole; and men in Ordnance use the sine bar in the shop.

Accurate knowledge of geometric forms obviously includes knowledge of the fundamental properties inherent in their definitions; but it also includes knowledge of other properties which may be deduced therefrom as well as still others derived from such formulas as those for the area of a plane figure, for the perimeter of a plane figure, and for the volume of a solid. These classes of properties may be illustrated. A square is a figure with four right angles and four equal sides. If this definition does not distort logic too much, it follows that the basic properties of the square are the four right angles and the four equal sides. By definition, lines are parallel when, if cut by a transversal, the corresponding angles are equal. This definition contains the fundamental properties of parallel lines; but others may be inferred. If the corresponding angles of parallel lines cut by a transversal are equal, then, since vertical angles are equal, so also are the alternate interior angles. From these inferred properties it follows (a) that the opposite angles of a parallelogram are equal and (b) that the sum of the angles of a triangle is 180°. The foregoing statements do not imply a course in systematic geometry. They show how to prevent facts and concepts from being learned as isolated and unique.

In the teaching of geometric concepts, the activity of drawing, besides developing a skill of importance in its own right (see Section O), is both a good instructional device and a good evaluating device. Drawing aids in learning geometric concepts by forcing attention to the critical aspects of the geometric form or concept in question and by affording practice in the use of protractors, dividers, and compasses. It aids in the evaluation of learning by setting a crucial test. The student who can reproduce geometric forms by drawing from memory has given evidence of learning that is more convincing than is the mere ability to define or to select from suggested alternative definitions.

In conclusion, let it be said once more that geometric concepts are learned when they can be used intelligently. The best preparation for intelligent use is learning and practice in concrete, practical situations, motivated wherever possible by personal need. One last example: (a) the formulas for area and volume can be memorized and immediately employed in computation; or, (b) they can be developed through concrete experience—that for area, by having the student count the number of one-inch squares required to cover a surface; that for volume, by having him fill a box with one-inch cubes. The result of procedure (a) will be superficial, useless knowledge. The result of (b), provided it is employed often enough and with different materials in different situations will be knowledge that will function in new problem situations.

O. Drawing and Construction
(Items 44–47)

In all branches of the service the training officers consulted marked as very frequently needed the ability to read blueprints, maps and sketches. In the case of maps, sketches, and grids (coordinate systems), the needed ability, they said, includes that of orientation with respect to compass bearings. In turn, the ability to orient, when the lines of the grid do not show compass north, involves the understanding of positive and negative numbers. (See Section L.) The requisite knowledge and abilities, it needs scarcely be pointed out, cannot be acquired by practice alone in examining completed grids, maps, and blueprints in textbooks. Here again mathematical sense is of critical importance. As is true elsewhere, mathematical sense in connection with maps and grids must be based upon understanding, and the needed understanding is most surely guaranteed by engaging in activities which go beyond the study of products which have already been worked out by others.

In the case of mapping, the scale is frequently given in the form of a representative fraction, R.F. (such as 1/20,000), where the numerator stands for a distance on the map and the denominator for a distance on the ground. The teacher will recognize that the particular R.F. mentioned is somewhat more difficult than the more usual forms, such as 1″=1 mi. (R.F., 1/63,360). (See the discussion of representative fractions in Section I.) Ability to read maps in which R.F.'s are stated includes, obviously, understanding of the particular R.F. employed and understanding of orientation. But instruction cannot stop at this point, because sometimes it is necessary to determine the R.F. from a foreign map when none is given on the map actually being used. In addition, the translation of an R.F. such as 1/63,360 so as to determine the number of yards between two points a certain number of inches apart on the map requires some computation, and practice should be given in this connection.

In the case of blueprint reading, the needed competences are (1) to use the measurement of parts given, (2) to find the dimensions of parts not given, and (3) to visualize the exact shape and form of the part represented. The last named ability is very complex; it includes some degree of abstraction and seems to be dependent on considerable experience both with reading and with making scale drawings.

The equipment needed in teaching drawing and construction within the limits of this report has been partly outlined in the section on Measurement (Section M). Obviously needed are rulers calibrated (1) to thirty-seconds of an inch and (2) to tenths of an inch. A reasonable approximation of the latter type of ruler can be obtained by using graph paper which is ruled 10 squares to the inch. Besides rulers, compasses, dividers, and protractors are essential. Use of drawing boards, T-squares, and drawing triangles will make experiences in scale drawing more valuable and more interesting. These last-named kinds of equipment need not be elaborate and can be made in the school shop or by the student at home. They facilitate the making of scale drawings because of the ease with which parallels and perpendiculars may be constructed. If drawing boards, T-squares, and triangles are lacking, graph paper will again make a good substitute, for the parallel and perpendicular lines on graph paper may be used to good effect. A wooden triangle and ruler can serve the same purpose.

So far as possible, instruction in drawing and construction should be definitely related to problems of real worth. Scale drawings of machine parts and of house plans should be made and studied; orthographic drawings of simple objects should be constructed; and, when feasible, as has already been suggested, blueprints should be studied. Problems requiring the finding of the side or hypotenuse of a right triangle can be set up from real situations arising inside or outside the classroom. In all drawing and construction, whether in such real problems or in practice work assigned to secure proficiency, the student must draw lines carefully so that they actually pass through the required points and draw angles so that they are the correct size. As in all other mathematical learning, the most accurate results are secured if each completed step is tested out by common sense checks.

Although the minimum objectives in drawing and construction are stated so as to include only the ability to read and understand, competence, even of this degree of simplicity, can be assured only by extension of the topics in classroom teaching. Many of the extensions may have but rare application in the Army but they contribute, as learning experiences, to the objectives sought for the skills in question as well as to other objectives discussed in earlier parts of this report. Some of these extensions are: the use of scale drawings to solve problems in indirect measurement by the construction of triangles, or to solve problems by the use of lines which represent force and direction (vectors); geometric constructions (as opposed to drawings made with the protractor and drawing board equipment) for erecting perpendiculars, bisecting angles and line segments, copying angles, and dividing a line segment into equal parts; and the Pythagorean relation. To these extensions may be added for students with adequate capacity, preparation, and interest, the use of tables of sines, cosines, and tangents in solving problems.

P. Miscellaneous
(Items 48–49)

Two topics that do not seem to belong in the categories already discussed are treated in this section. They are: measures of central tendency (average, median, mode) and rounding off numbers.

Average, median, mode.

The average (arithmetic mean) is used rather frequently, the median and mode less frequently, in the Army. Mention of these measures of central tendency should not imply systematic instruction in statistical procedure. Problems in finding the average of measures can be made to arise naturally throughout the work of the class. The median is easily taught as the middle measure of an odd number of measures, or as the average of two middlemost measures in an even number of measures. The mode should be found by inspection, from a frequency distribution. As a matter of fact, the median and mode may be found without grouping into class intervals. Instead, measures as given may be listed according to size from largest to smallest (or vice versa), all measures of the same value being grouped together. This simple procedure provides experience in the orderly consideration of numbers, in tallying, and in checking, skills all of which contribute to mathematical sense.

Rounding off numbers.

The student should be taught to round off numbers in such a way that greater accuracy is not pretended than is justified by the data. For example, when the other data in a problem are accurate to one or to two digits only, it is useless and misleading to take 3.1416 as the value of *pi*. In such instances the product may be close enough if the multiplier is 3.14 or even 3.

In rounding off numbers the usual rule is to increase the last retained figure by 1 if the figure dropped is 5, 6, 7, 8, or 9. But instruction on rounding off is incomplete if it includes only the teaching of this rule. The student should understand the reason for rounding off numbers and the occasions when numbers can and when they cannot be rounded off. A measurement of 0.992″ cannot be rounded off to 1″ if a machine part is concerned, but a measurement of 78′ may be called 100′ in setting communication poles if the terrain allows. Here again common sense must be combined with mathematics, and here again instruction must provide experience with practical situations in which the skill to be taught is involved.

SETTING UP THE INSTRUCTIONAL PROGRAM

Let it be stated again that the items listed previously must be part of the equipment of all Army inductees. On this point there is no distinction among prospective inductees who are in private schools or in public schools, who have left school for no particular reason, or who have positions in industry. In the age population concerned there is no distinction between prospective inductees who are in high school and those who are in the grades, or, within the high school, between those who are taking the four-year mathematics sequence and those who have had one year or less of mathematics since he eighth grade. This fact carries a number of implications for persons charged with the responsibility for organizing instructional programs.

(1) Students majoring in mathematics[12] need to be examined carefully to make sure hat they do have the needed ideas and skills. To the extent that they do not, provision should be made in each advanced course to correct all deficiencies. (And it should be repeated that this provision is nadequate if it consists only in "refresher" practice, to re-instate useless number tricks.) Furthermore, the content of these advanced courses should be studied carefully with a view (a) to eliminating material which will not function and (b) to ncluding vital applications arising from he emergency. In this connection, mathematics teachers should consult the report of the Office of Education Mathematics Committee, in which many valuable suggestions are offered. Also, they might well make use of the Seventeenth Yearbook of he National Council of Teachers of Mathematics (1942), entitled "A Source Book of Mathematical Applications."

(2) As for a special course, to provide students in school with the mathematical essentials, school officials must think in terms of the *ages* of students, not in terms of the *grade* level they may have reached. Physically able 16- and 17-year old prospective inductees will soon be in military service, whether at present they are high school students or are enrolled in the eighth grade. Steps should be taken to bring together in convenient groupings all students who are about to be inducted or are about to leave school for work. It is obvious that the school offers the readiest means of assembling prospective inductees for instructional purposes.

(3) Prospective inductees already out of school, for whatever reason, should be given an opportunity to make up their mathematical deficiencies. It is often possible to have special classes in public school buildings late in the afternoon or in the evening. Many business colleges are already offering such courses, as are many private industrial concerns. These agencies of pre-induction training should be encouraged and multiplied.

So much for the organization of classes from the standpoint of class membership. Next to be considered is a problem which is by no means easily solved but which is not hopeless. This is the problem of determining when students have acquired the necessary mathematical essentials.

This problem seems to be easy (indeed, it has been said by some to be relatively easy). It would be easy if we were concerned only with the traditional outcomes of mathematical competence, namely, abstract computation and problem solving. Many tests in these two areas are commercially available; and these tests may be trusted to reveal what they *can* reveal. For this reason their use can be justified.

But these tests do not, because they cannot, reveal the whole picture. Enough has already been said about the inadequacy of abstract computational skill as a basis for successful adjustment to Army life. The consistent tenor of this report has been that to computational competence must be added what has been called mathematical sense. And there is no commercial test of this outcome.

Yet, the lack of comprehensive and valid mathematical tests does not make the situation desperate. Mathematical sense (and its absence) is revealed under conditions of *use*. The boy who can quickly and accurately size up the quantitative aspects of concrete, practical situations and employ the correct mathematical techniques has passed the test of mathematical sense: he has acquired what the Army (and civilian life) wants him to have. The evidence he has given of his learning is wholly respectable, even if it has not been presented through a standard test or a locally prepared objective test. Evidence of his learning is of course secured through observation, and naturally the quality of observation will vary with the competence of the observer. We have assumed a competent observer.

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[12] There has already been a marked increase in the number of high school students in advanced courses in mathematics, and the trend will undoubtedly continue at least for the duration. Perhaps a word of caution is not amiss. Students should be encouraged to major in mathematics only when they have the capacity for such study. All other students should be guided into special classes based upon the minimum list of ideas and skills above, or upon extensions thereof.

Competence in observation is possible only when the observer knows (1) what he is looking for and (2) what constitutes sound evidence. In the case here in question, namely, in the evaluation of mathematical learning, the requirements for competent observation are readily stated, if not so readily realized. The teacher of mathematics must know (1) the outcomes he is seeking to attain in the behavior of his students and (2) the ways in which the students will behave if they achieve the outcomes set for them. As part of the latter requirement, he must know how to set up situations which will permit the behavior changes to reveal themselves.

Viewed in this way, evaluation is but part of the complete act of teaching. The good teacher evaluates continually,—necessarily so, for he is constantly on the alert for changes in behavior. Changes in the right direction inform him that he is teaching successfully; changes in the wrong direction, or no changes at all, tell him that his teaching is unsuccessful, and that he must try again in a different way.

The committee is not therefore shirking a responsibility when it offers no simple, mechanical method to determine when prospective inductees are mathematically ready for their tasks in the Army. There *is* no such simple mechanical method. The committee has presented a positive, practicable proposal: Let the mathematics course be taught by persons who know mathematics, not alone in the technical sense, but in the sense of concrete, sensible practicable application. Such teachers will be able to tell when their students have acquired the ideas and skills set in the minimum list. The present bulletin must stop where it does stop,—with the specifications for the job. Beyond this point responsibility lies in the hands of school officials and teachers. A careful study of this bulletin, the committee believes, will enable them to meet this responsibility more completely and more wisely.

1942-1943

I. Trends and Developments

1. Gifts to the Music Department

A. From Mrs. George P. Sanborn, Montclair, New Jer
scores and libretti (library).

B. From Miss Marjorie Quigley, Montclair Library,
New Jersey, violin and piano scores; art song a

C. Two recorders purchased from funds from the Coll
show.

2. The C.O.S. Howe memorial organ scholarships were he
Miss Ruth Russell and Miss Doris Stout. Each stude
received one hour lesson weekly from Mr. Carl F.
througnout the school year. Progress was satisfact

3. The following school-owned instruments were loaned
for use in the college orchestra and band:

Viola	Joan Egner
Viola	Philetta Forman
String Bass	Dorothy DeWitt
String Bass	Melvina Cannie
Oboe	Dolores Schreck
Oboe	Ellen Stein
Flute	Elizabeth Kardos
French Horn	Elizabeth Rand
Trumpet	Doris Stout
Baritone	Sylvia Collins
Euphonium	Carol Collin
Trombone	Helen Pollack
Mellophone	Genevieve Yellin
E flat Tuba	Michael Borello

As a means of developing the college orchestra and
these students received reguler instruction on the
struments, without charge.

4. Extra-Curricular Music Activities

A. Around the World in Folk Song, given by the Musi
College assembly program, November 10.

B. Around the World in Folk Song, given by the Musi
Montclair Women's Club, November 13.

C. Thanksgiving Dinner Music, given by the Student Trio, Edward Russ Hall, November 24.

D. Music of the Americas, given by the College Symphony Orchestra, Women's Club of Upper Montclair, December 7.

E. Old English Christmas Pageant, given by the Music Workshop, Montclair Women's Club, December 18.

F. Christmas Concert given by the college a cappella choir, Woman's Glee Club, Symphony orchestra and string ensemble, Union Congregational Church, December 21.

G. Old English Christmas Pageant given by the music workshop, Edward Russ Hall, December 22.

H. Around the World in Folk Song, given by the music workshop, Nutley High School, February 25.

I. Organ Recital given by the C. O. S. Howe Scholarship students, Edward Russ Hall, May 9.

J. Program given by the Faculty Trio, President Sprague's reception to the seniors, Edward Russ Hall, May 18.

K. Cabaret given by the music workshop, Edward Russ Hall, June 22.

L. Chamber Music Concert given by the Faculty Trio, Edward Russ Hall, June 27.

M. Program given by the Faculty Duo, President Sprague's reception to the seniors, Edward Russ Hall, August 11.
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5. Listening Room

The use of the listening room in Russ Hall has been spasmodic due to the fact that whenever the room has been needed for a student, it has been taken away. When available the listening room has been used as much as forty hours a week.

6. Faculty Record Lending Service.
Records have been loaned to faculty members for home listening. Six faculty members have availed themselves of this service.

7. Metropolitan Opera Tickets.
During the past year sixty-four students have attended performances at the Metropolitan Opera, New York City. This has been made possible through the purchase of the Music Department of four season tickets which in turn have been sold to the students.

*N. Several programs given by the College a cappella choir in the high schools of New Jersey.

8. Music Library.

Music students have facilitated the work of the music library in the following ways.

A. Project by the Senior music minors - a subject matter index for the following books and magazines in the library:

   (1) Music Educator's National Conference Annual Book of Proceedings.

   (2) Music Teacher's National Association, Annual Book of Proceedings.

   (3) Music Educator's Journal.

B. Project by the junior music minors - "Music History up to Date"; collecting music editorials, criticisms, reviews, etc., from the New York Times, Herald Tribune and World Telegram for Music History scrapbook, 1943. This is bound and placed in the library.

C. Project by the sophomore music minors. Subject matter index for the following magazines in the library:

   (1) Musical Quarterly
   (2) Modern Music
   (3) Musical America
   (4) The Etude
   (5) The American Music Lover

9. The Music Workshop

Probably the most significant development in the music department during the past year has been the music workshop.

The purpose of the music workshop is to provide every student with an opportunity to express himself through music, each in accordance with his ability. Students are encouraged to make music in every possible way; with the voice, on the recorder, guitar, banjo, accordion, piano, band and orchestra instruments. In particular favor are the folk-like instruments which may be used to accompany singing. These instruments not only have the advantage of being easy to play, but lend themselves readily to a social situation.

The music workshop in no way duplicates the activities of the college choir, orchestra or band. Unlike these organizations, the music workshop is concerned primarily with small vocal and instrumental ensembles with one performer to a part.

Music workshop activities are organized on a project basis. Interest is keen because 1) projects are self initiated; 2) they provide a growing sense of power in musical expression, and 3) function in a social situation.

During the past year 43 students have participated in music workshop projects. These projects have included:

Vocal duets, trios, and quartets,
Piano duets and quartets,
Organ and piano duos,
Violin duets,
Trumpet duets,
String trio,
Accordion duets and quartets,
Folk song dramatizations,
Christmas pageant,
Accompaniments for step singing.

II. Enrollment Data

Undergraduate music minors

Sophomore	
Regular	6
Accelerated	9
Junior	
Regular	8
Accelerated	5
Senior	
Regular	5
Accelerated	4
Extension Students	12

III. Courses Taught During 1942-1943

Title	No. of Sections	Instructor
Music and Art Appreciation	5	McEachern
Music Theory (Sight Reading and Ear Training)	2	"
Music Theory (Harmony)	2	"
Teaching of High School Music	2	"
Development of the Opera	2	"
Music Literature	2	"
Epochs in Musical Development	2	"
Choral Technique	1	"
Music in Modern Society	1	"
Instrumental Technique	2	Guerrera

IV. Staff

Edna McEachern, full time
Carl F. Mueller, part time
Emil Kahn, part time
Anthony Guerrera, part time
Victor deVeritch, part time

V. Studies undertaken by the Department

1. Inter-Departmental Music Service Sheet.

   A list of recorded music suggested for use in the integration of music with Social Studies, English, and modern languages. These sheets are available to the faculty and students.

2. Syllabus for teaching the course, "Music in Modern Society".

3. Source Book on Philosophy of Music -
   A compilation of quotations and excerpts on music philosophy and aesthetics gleaned from wide reading in the fields of the fine arts, history and science. This book is similar in form and purpose to the Source Book in Philosophy of Education by Dr. Kilpatrick, Teachers College, Columbia University (library).

4. Syllabus for teaching keyboard harmony (in use in Music 201, 202).

VI. Recommendations

I wish to make the following recommendations relative to our music offerings:

1. A permanent listening room in the administration building to which students will have access during the school day.

2. A permanent room for the music workshop, in which students may practice during the school day. This room should be equipped with a piano and made sound proof.

3. The development of a program of private instruction in applied music; i.e., performance skills in voice, piano, violin and other instruments; said instruction to be given by staff members of the college to college students for a nominal fee.

4. Credit to the extent of four semester-hours to music minors for work in applied music.

Respectfully submitted,

Edna McEachern
Director of the Department of Music

ANNUAL REPORT
PHYSICAL EDUCATION FOR WOMEN
1942-1943

The Department of Physical Education for Women has changed in some respects during this first war year. While the work has gone on under the same general plan as formerly, certain changes were advisable. The accelerated program in the college required program adjustment, and added demands on the students affected our activities. A freshman class was admitted in February, but the new section fitted smoothly into the schedule and into the athletic program. In order to provide for accelerated juniors minoring in Physical Education, it was necessary to offer schedule classes in the summer session. With the wish to help meet the shortage of teachers of Physical Education, a work-shop course was offered during the summer. The number taking the course was not large, but because they were already teaching Physical Education, or planned to during the next year, their interest was keen and their approach to the subject mature and practical. Mr. Franklin Armstrong, Director of Physical Education in Montclair, conducted the course.

With these changes, the regular college courses were carried on.

The work of the Department falls under four main headings: 1. The required courses for the women of the college. 2. The courses that are offered for women who minor in physical education. 3. The extra-curricular activities. 4. The required and extra-curricular activities for the high school.

1. Two years of physical education are required of all students for graduation. In all but a few cases, this work is completed in the freshman and sophomore years, but each year a few upper classmen are enrolled. This year the enrollment by classes was as follows: 163 freshmen, 120 sophomores, 12 juniors, and 10 seniors. 24 students were limited in their activities and 5 were unable to participate for medical reasons. Each student is given a medical examination by Dr. Wurts, the results of which determine her fitness and regulate her program. The curriculum included team sports, dual and

individual sports, dancing, and exercises. This year additional emphasis was put upon definite exercises which were given for the purpose of developing strength and endurance. The addition of this type of work was a direct response to the war-time program which was suggested in the Victory Corps program. The object was to add more vigorous activity to the program, at the same time retaining those activities that had proved their value. The response of the students was very satisfactory and we will continue to follow the same plan. The sports, games, and dances which were taught in the classes were not only interesting to the students, but were material that should be useful to future teachers. A number of students volunteer their services to community organizations. We continued to cooperate with the Montclair Council, Girl Scouts; we were also able to help the Women's Division, Y.M.C.A. with their club program.

In the summer session, required physical education was offered for the first time. The plan worked out satisfactorily: 5 minors completed their junior course; 58 regular students were enrolled.

In the spring, the decision was made that Physical Education be put on credit basis - one semester-hour's credit each semester for two years. I feel that this is a forward step and that the department will benefit from this academic recognition.

2. Nine sophomores, four juniors, and five seniors minored in Physical Education. They were enthusiastic and contributed generously of their time and effort in departmental activities. Three were employed as group leaders by the Montclair ~~Defense~~ Recreation Council. All helped in high school and college classes.

3. The extra-curricular program was continued successfully in spite of increased responsibilities for most of the girls because of war activities. The program was sponsored by the Women's Athletic Association, supervised by Miss Sherwin and me. 24 girls participated in field hockey, 100 in volley ball, 84 in basketball, 42 in soft ball, and 28 in archery. Because of food

rationing and war-time restrictions, the annual banquet was not held. In its place we had a tea at which the final awards were given and the incoming officers installed.

We regretted that the very pleasant contacts that we had in other years with other colleges in the State were not possible, chiefly because of transportation difficulties.

4. Each student in the high school is required to take two periods of Physical Education a week. The combined classes had the following enrollments: 7th and 8th grades - 25, 9th and 10th grades - 32, 11th and 12th grades - 26. In the high school, too, we followed the suggestion of the Victory Corps manual. Exercises were added, group games stressed, and less time was spent on team games in class time. Team games comprised the programs of the junior and senior Athletic Associations, which continued very successfully. Ten girls from the 7th and 8th grades joined the Junior A. A. In the Senior A. A., 29 played hocker, 34 basketball, 15 bowling, and 9 softball.

Under Miss Sherwin's direction, the Dance Club continued to be very popular and very active. While recitals had been given up for the duration, the club presented a program in January. It was greatly enjoyed and all regret that it will be impossible to offer another in the near future. The membership of the Club was 58.

The first change in the Department in many years took place this fall; Miss Sherwin was appointed Dean of Women and left the Department she has served so faithfully and well. It is with regret that I see her leave, and shall continue to look to her for interest and support. Miss Margaret Clark has been appointed to the position and will assume her duties in the new college year.

I should like to make the following recommendations:

The need for silencing the high school gymnasium is still very great. It is a very difficult situation in which to teach and the instruc-

tional period is not as efficient as it should be.

The gymnasium and locker rooms need to be cleaned more often and more thoroughly. The slippery floor indicates that it should be washed more often, especially after dances.

The problem of the bleachers in the gymnasium still needs to be solved. When they are left up they constitute a real hazard to the group that is playing.

The tennis courts are in sore need of attention and repair. They are so neglected that they are not put to their full use, which is regrettable, when regular care would keep them in order for class and general play.

Respectfully submitted,

Dorothy Duke

Director of Physical Education
for Women

DEPARTMENT OF PHYSICAL EDUCATION FOR MEN
ANNUAL REPORT
1942-1943

CURRICULUM

The matter of so many men students being called into military service depleted the male enrollment to such an extent that our classes were rather small. The physical education minor classes were too small for good work to be done, so that no classes were offered the first semester of 1943.

This year was the first time that physical education was required three times per week of all freshmen and sophomores. We had quite a bit of trouble in arranging extra class periods so as to include all of these students. However, the obvious results from these men taking gym three times per week was so gratifying that I hope the college administration will get behind this matter wholeheartedly and give us the opportunity of making physical education very much worth while in the lives of our men.

As a part of the regular training program we gave the Rogers Physical Fitness test to all men in September, and again in May of the following spring and the results were very pleasing. We had to borrow the equipment to give these tests, but after getting such good results, we obtained new equipment of our own to carry on these same tests.

STAFF CHANGES

In January 1943, Mr. Howard Glover was called into the armed services. Mr. Glover had been handling all of the College High School health and physical education work. This left it up to Mr. Brinley and me to absorb the work left by his leaving.

In June 1943, Mr. Brinley accepted a position at Great Neck, Long Island. Nothing was done at that time or duting the summer to get a man to fill the vacancy due to the uncertainty of what work there would be in the college in physical education in the fall. When school began in September there were fifty-six men in college and the regular quota of high school boys in attendance. This set up a task too difficult for one man to handle and we began a search for a man for full time to assist in handling the work. To date, we have had no success in obtaining any one for the position. During this time, all college and high school work has been handled alone by myself.

EXTENSION AND SUMMER SESSION

In September 1942, extension classes in physical education were offered but did not fill so were dropped. None were offered in the spring.

To try to meet the demands for physical education instructors in the high schools of the state, a "WORK SHOP" course in physical education was offered during the summer school period. Mr. Pittser had been given permission to be absent from summer school and Mr. Franklin Armstrong was obtained to teach the course. The material offered in this course was made up of four two-point courses, namely, Principles and Problems of Physical Education, Organization and Methods in Physical Education, Games and Game Skills, and School Health Service Program. This course gave a total of eight credit points. There were only six students who enrolled for the course.

VARSITY ATHLETIC PROGRAM

We thought it would be the best thing to do to try to keep football going as long as possible, even though under unusual circumstances. We were able to schedule only four games, of which we won two and lost two. The spirit and morale of the players was good at the first of the season but their interest dwindled toward the end of the season. I felt this was due to the war situation. All of them were to be in the armed services before the end of the year and they were anxious to get out of school. No attempt was made to schedule games or make any attempt to have a team during 1943-1944.

Varsity basketball was more worth while than football and we played a full schedule of twenty-five games, winning thirteen and losing twelve. The morale of these men was high all year, and I feel that it was due to the fact that almost all the squad was made up of Irishmen.

We tried to carry on baseball but with rather discouraging results. Not so much because we won only one game out of five, but because at this time of year, most of the boys knew when they were leaving for military service and they were more interested in other things than baseball.

Both wrestling and track were dropped for the duration due to no material or interest and also because it was hard to find any competition.

INTRAMURAL SPORTS

An attempt was made to carry on an intramural program but it was a miserable failure. Again, as it has always been the case, the gymnasium is available so little of the time when men students can put in the time for this program that we could not get enough of them to stay for the sports. Also, most men were working as soon as they could get away from the college and that was a hindrance. Intramural sports could and should be one of our most worth while physical education activities, but time and facilities militate against their success.

WORTH WHILE DEVELOPMENTS

In September 1942, Mr. Brinley and I laid out two commando courses on the campus, using only the natural hazards which abound on the campus. These courses were used in connection with our gym classes and varsity athletics as conditioning exercises. Within the past six months, a good many letters have been received from former students now in the armed forces, and they have praised us for what good they had received from their experiences and training over these courses.

Also, a good may of the men have told us how much they appreciate the good they received from the regular gym classes. They found the Army and Navy training programs not too strenuous, due to their condition.

DEPARTMENT RECOMMENDATIONS

Due to the fact that we have had such flattering results from meeting all freshmen and sophomores three times per week in required gym classes, I wish to recommend that these classes be definitely assigned three class periods by the Registrar. The way we have had to do this up to now has caused us to have too many classes with fewer than six men to a class and this does not make for good physical fitness.

I wish to again recommend that graduate students who are working for their administrative certificates be required to take the following courses:

1. Physical Education 410 - Principles and Philosophy of Physical Education
2. Physical Education 412 - School Health Service Program

It is my sincere belief that there are far too many high school administrators who are not acquainted with the fundamental requirements of the field of health and physical education. Their lack of knowledge has caused a lack of interest in this area of the all-round education of the child and the results of lax physical education requirements have been sadly demonstrated in the armed forces draft figures.

I wish to wholeheartedly recommend that Montclair State Teachers College start immediately on the development of a physical education major training course. I believe that this is going to be the field in which the most drastic adjustments and developments will take place in the school systems after the war is over.

It is my opinion that there is not a good physical education training course anywhere in the New Jersey area and Montclair is in the most strategic position, geographically, to provide this training for the high schools of New Jersey. We would need improved facilities and an increased staff to give this course. The material good that could be done for the schools of the state would easily offset these costs.

Respectfully submitted,

Chester M. Pittser,
Director of Physical Education

SCIENCE DEPARTMENT

ANNUAL REPORT

1942-1943

RECOMMENDATIONS

The amazing development of aviation in recent years makes it necessary for the science department to plan for suitable equipment for this subject. We need a small building constructed of concrete blocks and large enough to accomodate two light airplanes, a small classroom space, and some shop bench space. This should be located on the back campus on the edge of the atheletic field and so arranged that the planes could easily be taken out of the building for study. No provision for flying is needed but a level area is needed for some motion of the planes on the ground. For the present it would not be necessary to provide gas, water, or electric services buta stove should be installed in the classroom.

STAFF CHANGES

During the month of November, 1942, Mr. George R. Placek entered Naval Service and was later transfered to the Naval Air Station, Hutchinson, Kansas. A substitute teacher was employed to take charge of three of Mr. Placek's classes. The fourth, high school physics, was taken by the head of the science department.

Miss Sally Ransom was appointed to take charge of the general science and chemistry classes in the College High School. The term of service to begin in September, 1943.

ENROLLMENT DATA

The following pages give the enrollment data for:

A. Fall Semester, 1942

B. Spring Semester, 1943

C. Summer Quarter, 1943

These figures on enrollment include students in the classes of the following instructors:

Dean Charles W. Finley

Professor Earl R. Glenn

Dr. Charles E. Hadley

Dr. Rufus D. Reed

Dr. K. O. Smith

Mrs. Ethel J. Ramsden

Mr. George R. Placek

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

SCIENCE DEPARTMENT

ANNUAL REPORT: YEAR 1942-1943 INSTRUCTOR Dean Charles W. Finley

FALL SEMESTER 1942

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Science	100B	Biological Sciences	2			65
Science	100B	Biological Sciences	2			48

SPRING SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Science	100B	Biological Sciences	2			53
Science	100B	Biological Sciences	2			55
Science	100B	Biological Sciences	2			41

SUMMER QUARTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
		NOT IN RESIDENCE				

*Records for high school classes to appear in "Total" only.

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

SCIENCE DEPARTMENT

ANNUAL REPORT: Year 1942-1943 Instructor Professor Earl R. Glenn

FALL SEMESTER 1942

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Science	404	Problems in Teaching Science	2			19
Science	100A	Physical Sciences	2			24
Science	100A	Physical Sciences	2			30
Science	100A	Physical Sciences	2			45
Physics	12	High School Physics	3			16

SPRING SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Physics	12	High School Physics	6			17
Science	404	Problems in Teaching Science	2	7		7
Science	100A	Physical Sciences	2			34
Science	100A	Physical Sciences	2			49

SUMMER QUARTER 1943

July 6 - August 13

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Physics	304	Photography	2			4
Physics	407A	Aviation	2			7
Science	100A	Physical Sciences	2			42

*Records for high school classes to appear in "Total"only.

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

Science Department

ANNUAL REPORT: YEAR 1942-1943 INSTRUCTOR Dr. Charles E. Hadley

FALL SEMESTER 1942

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Biology	101	Botany	4	26	2	28
Biology	202	Zoology	4	14	2	16
Biology	410	Comp. Anatomy	4	6	1	7

SPRING SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Biology	101	Botany	4	11	0	11
Biology	102	Botany	4	20	2	22
Biology	409	Physiology	4	13	0	13

SUMMER SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Biology	102	Botany	4	9	0	9
Biology	201	Zoology	4	7	4	11
Biology		Medical Technique	4	13	1	14

*Records for high school classes to appear in "Total" only.

148

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

SCIENCE DEPARTMENT

NUAL REPORT: YEAR 1942-1943 INSTRUCTOR Rufus D. Reed

FALL SEMESTER 1942

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Chemistry	101	General College Chemistry	4	19	4	23
Chemistry	[illegible]	Analytical Chemistry	4	14	1	15
Chemistry	406	Organic Chemistry	4	7	1	8
Chemistry	405	Organic Chemistry	4	9	2	11

SPRING SEMESTER 1943

Course	Number	Title	Credit	Enrollment Majors	Minors	Total
Chemistry	102	General College Chemistry	4	19	3	22
Chemistry	201	Qualitative Analytical Chemistry	4	12	1	13
Chemistry	406	Organic Chemistry	4	6	2	8
Chemistry						

SUMMER SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Chemistry	101	General College Chemistry	[illegible]	[illegible]	2	18
Chemistry	201	Qualitative Analytical Chemistry	4	6	4	10
Chemistry	510	Foods Biochemistry Nutrition	4	12	5	17

*Records for high school classes to appear in "Total" only.

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

SCIENCE DEPARTMENT

ANNUAL REPORT: YEAR 1942-1943 INSTRUCTOR Dr. K. O. Smith

FALL SEMESTER 1942

Course	Number	Title	Credit	*Enrollment Major	Minors	Total
Physics	405	Optical Instruments	4	2	5	7
Physics	102	General Physics	4	19	1	20
Physics	101	General Physics	4	6	6	12

SPRING SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Major	Minor	Total
Physics	402	Advanced Electricity	4	6	0	6
Physics	102	General Physics	4	16	5	21
Physics	101	General Physics	4	10	7	17

SUMMER SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
Physics	402	Advanced Electricity	4	13	3	16
Physics	102	General Physics	4	6	8	14
Physics	101	General Physics	4	9	11	20

*Records for high school classes to appear in "Total" only.

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

SCIENCE DEPARTMENT

ANNUAL REPORT: YEAR 1942-1943 INSTRUCTOR N. J. Ramsden

FALL SEMESTER 1943

Course	Number	Title	Credit	Enrollment Majors	 Minors	Total
Biology	201	Zoology	4	[illegible]	3	5
Biology		Biology 10	5			28
Biology		Science 9	4			26

SPRING SEMESTER 1943

Course	Number	Title	Credit	Enrollment Majors	 Minors	Total
Biology	202	Zoology	4	2	3	5
Biology		Biology 10	5			[illegible]
Biology		Science 9	4			26

SUMMER SEMESTER 1943

Course	Number	Title	Credit	Enrollment Majors	 Minors	Total
	Not in	Residence				

*Records for high school classes to appear in "Total" only.

NEW JERSEY STATE TEACHERS COLLEGE AT MONTCLAIR

SCIENCE DEPARTMENT

NUAL REPORT: YEAR 1942-1943 INSTRUCTOR: George R. Placek
and substitute teacher

FALL SEMESTER 1942

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
cience	7	General Science	3			23
cience	8	General Science	4			26
hemistry	11	High School Chemistry	5			12
ysics	12	High School Physics	6			16

SPRING SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
cience	7	General Science	3			23
cience	8	General Science	4			26
hemistry	11	High School Chemistry	5			22

SUMMER SEMESTER 1943

Course	Number	Title	Credit	*Enrollment Majors	Minors	Total
		Not in Residence				

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* Records for high school classes to appear in "Total" only.

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